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ARKANSAS OIL FIELD WASTES AS RELATED TO LAKE CORNEY AND CORNEY CREEK POLLUTION IN VICINITY OF ARKANSAS-LOUISIANA STATE LINE

Hayse H. Black, Sr.

Environmental Health Center
Cincinnati, Ohio

September 1949

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Federal Security Agency
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By

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PRELIMINARY INVESTIGATION OF ARKANSAS OIL FIELD WASTES AS RELATED TO LAKE CORNEY AND CORNEY CREEK POLLUTION IN VICINITY OF ARKANSAS-LOUISIANA STATE LINE

Fish destruction in Corney Creek between Lake Corney (Louisiana) and the Louisiana-Arkansas state line has been observed by fishermen on several occasions during the past eight years. Sportsmen in Haynesville and Homer, Claiborne Parish, Louisiana, attribute the condition of Corney Lake and the absence of good fishing to Corney Creek pollution by brine originating in the Schuler and Village oil fields in Arkansas. These conditions prompted the official complaints which resulted in the investigation covered by this report.

1. Inspection Dates

July 13 and 14, 1949.

2. Personnel Participating

The names of men participating in this investigation and the organization that each represented are given in Appendix A.

3. Purpose

This investigation was scheduled by the Environmental Health Center June 27, 1949, letter directed to Arkansas Water Pollution Control Commission. This letter suggested an early joint investigation of Corney Creek, Corney Lake, and pollution sources, with representatives of the Fish and Wildlife Service, the Louisiana Stream Control Commission, and other interested agencies. The principal objectives were to determine the cause for intermittent fish destruc-

tion in Corney Creek, above Corney Lake, during the past several years and to consider possible measures for abating pollution caused by Arkansas oil fields located in Corney Creek drainage basin.

4. Complaints

C. W. James, Ruston, Louisiana, acting in the interests of local citizens, filed an official complaint with Hon. Otto E. Passman, Member of Congress, early in 1949, alleging objectionable pollution of Corney Creek attributed to drainage from the Village oil field, Columbia County, Arkansas. Congressman Passman referred this complaint to the Fish and Wildlife Service by letter dated May 24, 1949. Director Day suggested a joint investigation of this pollution problem with representatives of the U. S. Public Health Service. This suggestion resulted in the June 21, 1949, letter from Congressman Passman to Surgeon General Scheele and this field investigation. Copies of letters referred to and other pertinent correspondence are included as a matter of record, Appendices B-1 to B-7 inclusive.

5. Maps of Area

Corney Creek is a relatively small stream rising in Columbia County, Arkansas, and flowing in a southeasterly direction through Claiborne and Union Parishes in north Louisiana. This stream feeds Corney Lake, an impounding reservoir located near the east edge of Claiborne County. Corney Creek continues on to confluence with Bayou d'Arbonne

near Farmerville, which stream in turn joins Ouachita River at Monroe, Louisiana. A map designated "Corney Creek Drainage Basin above Lake Corney Showing Oil Fields and Stream Sampling Points, July, 1949" is included as Appendix C.

6. Pollution Sources

The principal known source of pollutional wastes on Corney Creek drainage basin above Lake Corney is the discharge from oil fields in the state of Arkansas. This discharge consists of brine and petroleum wastes from producing leases. The Village Field and portions of Atlanta, Schuler, and Magnolia fields drain either directly to Corney Creek or to its tributaries.

Four unincorporated communities are located wholly or in part on this watershed. These communities have neither public water supplies nor sewerage systems. Rand McNally Commercial Atlas and Marketing Guide, 76th edition, 1945, gives population statistics for three of these communities as:

Atlanta	163
Village	150
Schuler	50

Scottsville, Louisiana, is shown on the map, Appendix C, but the Rand McNally atlas does not list it.

7. Previous Investigations

Records of field investigations of Lake Corney, Corney Creek, and principal tributaries date from August 1, 1941. Copies of reports covering these investigations have been made available by the Louisiana Stream Control Commission

and are reproduced herewith as Appendices D-1 to D-11, inclusive. The first six reports were prepared during the period August 1, 1941, to October 29, 1943, by representatives of the Louisiana Department of Conservation, Division of Research and Statistics. Representatives of the Soil Conservation Service, U. S. Department of Agriculture, have accumulated chloride data on both Corney Lake and the contributing streams during 1948 and 1949. These data and recorded observations make up the remaining five reports.

The highest chloride values observed were reported as 14,400 parts per million by Thomas M. Logan at the time of his August 1, 1941, investigation. These concentrations occurred in Three Creeks below the Schuler field during a period of low stream flow. Considerable crystallized salt was reported in the immediate vicinity of the sampling points, which salt would readily solubilize during a rain. In fact, it was reported that a great many dead fish had been observed following rains in the two main branches of Three Creeks Corney Creek below confluence with Three Creeks had a chloride content of 218 parts per million at the time of this inspection

Brine production reported by the Arkansas Oil and Gas Commission for 1941 from the Reynolds Lime Pool, Schuler Field totaled 486,386 barrels. The Commission records indicate that water injection was not started in the Schuler Field until 1944.

The Soil Conservation Service has reported chloride con-

centrations up to 1473 parts per million in Big Corney Creek, 3-1/2 miles above Lake Corney, and 2285 parts per million near Atlenta, Arkansas, Appendices D-10 and D-9. The more recent stream and lake chloride data support the contention of complainants that brine discharge to Corney Creek from the Arkansas oil fields has increased during the past few years.

8. Testimonials

Arrangements were made by C. W. James, contractor, Ruston, Louisiana, for interested citizens from Claiborne and Union Parishes to present testimony before representatives of Arkansas State Board of Health, Arkansas Game and Fish Commission, Louisiana Stream Control Commission, and the U. S. Public Health Service, July 14, 1949. This meeting was held at the Fielder Concession which is located on the west bank of Corney Lake. The names of nineteen sportsmen who testified are recorded in Appendix E.

A number of the complainants reported having seen large numbers of dead fish in Corney Creek between Lake Corney and the Arkansas-Louisiana state line early in December, 1948, and again during the first week of January, 1949. Others reported having seen dead fish in this stream in the spring of 1947 and during October and November, 1948. For the most part these fish kills followed heavy rainfall on the Corney Creek watershed. The principal fish species reported killed were catfish, bream, and bass. This group was unanimous in reporting that fish had become progressively more scarce in

Lake Corney during the past few years. However, no mass killing of fish in Lake Corney was reported.

Oil Fields Investigated

Opportunity was afforded July 13 to inspect some producing leases in the Atlanta, Village, and Schuler oil fields. The east half of Magnolia Oil Field also drains to Corney Creek. Valuable information regarding these oil fields and their production appears in reports of the Arkansas Oil and Gas Commission. (See references No. 1 and 2 in Table of Contents).

9. Atlanta

The Atlanta field is an east-west trending anticline about six miles in length and one-half to one mile wide located some 3-1/2 miles north of the village of Atlanta. The discovery well was drilled to a depth of 8,232 feet and completed December 19, 1938, in the Reynolds limestone. As of December, 1948, fifty-three wells were producing from this formation.

Cotton Valley production was first obtained in the Atlanta Field on July 4, 1943. During the period 1943 to 1948, only one or two wells produced from the Cotton Valley sands. The number of producing wells was increased to five in September, 1948.

Cumulative oil production from the Reynolds Lime Pool

through 1948 was reported as 10,604,773 barrels. Potential recovery from this field has been estimated at 20,000,000 barrels.

10. Magnolia

The Magnolia Field is the most important accumulation of petroleum found thus far in the Reynolds zone of the Smackover limestone. The discovery well was completed March 5, 1938, at a depth of 7649 feet. Structurally, the Magnolia Field is a symmetrical anticline six miles long and about one and one-half miles wide located some two miles east of the town of Magnolia. There were 108 wells producing from the Reynolds Lime Pool in December, 1948.

The Cotton Valley Pool was not developed in the Magnolia Field until 1948. Six producing wells were drilled during the year. Computed oil in the original reservoir was 3,770,000 barrels, with an estimated recovery factor of 30%. Cumulative production from Cotton Valley sands in this pool at the end of 1948 was 126,354 barrels.

Cumulative oil production from the Reynolds Lime Pool through 1948 was 55,124,753 barrels. It has been estimated that 140,000,000 barrels of oil may be recoverable.

11. Schuler

The Schuler field covers portions of nine sections being located some eighteen miles west and south of El Dorado in the west central part of Union County. There are four producing zones in this field. These are referred to as:

Morgan zone, Leona zone, Jones sand, and Reynolds oölite.

Seismograph exploration in 1936 led to the discovery of the field. The discovery well in the Jones sand is officially recorded as September 17, 1937, being completed at a total depth of 7615 feet. The Jones sand has been the most productive formation, having a cumulative oil production of 46,152,390 barrels at the end of 1948. Computed oil in the original reservoir was 99,000,000 barrels, with an estimated recovery factor of 65%.

Initial development of the Morgan sands and the Reynolds oölite was likewise initiated in 1937. The Leona zone was not developed until the spring of 1941. Next to the Jones sand, the Reynolds pool has been the largest producer, with 6,985,498 barrels oil production at the end of 1948. This reservoir originally contained 13,000,000 barrels and has a potential recovery of 60%. Production from the Morgan sands declined rapidly and the Leona sand production has been relatively low. There were 161 wells producing from the three formations during 1948.

12. Village

The Village field is located in Columbia County, slightly over one mile northeast of the Magnolia field and about 22 miles west of El Dorado along Highway 82. The discovery well was completed May 26, 1938, at a total depth of 7,388 feet, the production coming from porous oölitic Reynolds limestone. The Cotton Valley and Travis Peak pools were not developed until 1946.

The Reynolds Lime pool is the largest, with 44 wells producing during the last half of 1948. Cumulative oil production from the Reynolds limestone was 6,763,443 barrels as of December, 1948. The original reservoir contained 39,700,000 barrels, with 50% recovery factor.

The Travis Peak pool is second in size, with the original reservoir containing 25,800,000 barrels of oil and having an estimated recovery of 50%. There were 40 wells producing from this pool in December, 1948. There were 93 wells producing from the three formations in December, 1948.

Oil Field Brine

The Arkansas Oil and Gas Commission maintains a very complete record of brine production and water injected into subsurface formations. Recent Commission reports are the source of the information contained in this section.

13. Analyses

Salinity of brine from the different oil-producing formations varies substantially. The characteristics of brine from two formations reported in the 1946 Commission Survey Reports prepared by Faneher and MacKay, pages 164 and 236, are tabulated below:

Analysis of Salt Water from the
Cotton Valley Sand, Atlanta Field

Constituent	(S.17, T.18-S., R.19-W.) (p. p. m.)
Calcium	10,210
Magnesium	1,083
Sodium	24,005
Sulfates	102
Bicarbonates as HCO_3	23
Chlorides	58,150
Total solids	93,573
Specific gravity ($60^oF.$)	1,065

Analysis of Salt Water from the
Smackover Limestone, Village Field

Constituent	(S.10, T.17-S., R.19-W.) (p. p. m.)
Calcium	42,561
Magnesium	4,128
Iron and aluminum	nil.
Sulfates	172
Carbonates	nil.
Bicarbonates as $CaCO_3$	114
Chlorides	183,151
Total solids	373,520
pH	5.8

These two sets of analyses are the extremes reported for the four oil fields located wholly or in part on the Corney Creek drainage basin. Brine produced from the Morgan and Jones sands in the Schuler field approaches the concentration reported for the Reynolds zone, Smackover Limestone, more closely than brine from the Cotton Valley sand. The same is true for brine produced in the Magnolia field.

14. Production

A study has been made of brine production in the four oil fields covered by this investigation. The amount of brine produced in each field for each year during the five-year period 1944 to 1948 inclusive has been tabulated as Appendices F-1 to F-4. These records were taken from the Arkansas Oil and Gas Commission Factual Data Report #53. In reviewing these brine production tables, it should be kept in mind that substantial portions of the Magnolia and Schuler fields lie outside Corney Creek drainage basin.

The four Arkansas oil fields covered by this investigation were all discovered about the same time, 1937-38. However, the Magnolia and Schuler fields were developed more rapidly than the Atlanta and Village fields Oil production and corresponding brine production have increased progressively in the Atlanta and Village fields since their discovery.

Consideration was given to the rate of brine production in these four oil fields. The water produced per barrel of

oil in each of these fields during each year of the five-year period 1944 to 1948 inclusive is tabulated as Appendix F-5. The rate of brine production is shown graphically in Appendix G. This graph shows a consistent rate of increase in brine production in the Atlanta field and, with the exception of 1947, an increasing rate in the Village field.

The actual volume of brine produced in the Atlanta and Village fields has increased substantially in recent years. Brine from the Atlanta field increased from 582,666 barrels in 1946 to 1,522,600 barrels in 1948, or 162 per cent. Likewise, brine from the Village field increased from 843,438 barrels in 1946 to 2,191,078 barrels in 1948, an increase of 160 per cent.

15. Injection

The Village field is the only oil field on Corney Creek drainage basin that does not return brine to a subsurface formation to augment reservoir energy. In this connection, the opinion was expressed that water being injected into the Reynolds zone of the Smackover limestone in the Magnolia field may actually be increasing brine pumpage from the Village field.

The possibility of subsurface brine disposal from the Village field was discussed July 13 with officials of the Arkansas Oil and Gas Commission at Eldorado. It was reported that a survey of the Village field had just been completed.

Although the results of this study were not available, it was stated that the oil producers involved have maintained, in the past, that a Village field repressuring system would not be a sound financial investment. However, there are existing wells on the edge of the Village field that could be converted to gravity brine wells. The principal expenditure would be for the brine collection system. The Oil and Gas Commission, because of extended and intimate professional contact with the Arkansas oil producers, is the logical agency to promote a brine injection system for the Village field.

Regular water injection into the Smackover limestone in the Atlanta field was begun August 25, 1946. This project was prompted by success of pressure maintenance in the Midway pool and the beneficial results obtained by injecting salt water into flank wells in the Magnolia field. During the period August 25, 1946, and July 1, 1947, approximately 521,000 barrels of salt water were injected into the Smackover limestone reservoir, Atlanta field. A detailed report on this development was prepared by the Bureau of Mines, R.I. 4455, dated June, 1949. (See reference).

Operators of the Magnolia field agreed in 1945 to participate in the co-operative installation and operation of a salt water disposal and pressure maintenance system for the field, involving the injection of salt water into the Reynolds zone of the Smackover limestone, with the Carter

Oil Company as the operator. One injection well was drilled in 1945 and three additional input wells were completed prior to June, 1946. Three of these wells initially took 3000 barrels of water per day under gravity head. Fresh water from a shallow water sand is used to augment the amount of water injected. In general, brine and fresh water are injected in approximately equal volumes as indicated in the table, Appendix F-2.

Return of brine to the Jones sand, Schuler field, was initiated in June, 1944, using an oil well which had gone to water. The Fancher and Mackay report for the Oil and Gas Commission, page 227, states that fresh water was also injected. Referring to the table, Appendix F-3, it is apparent that a considerable volume of brine produced in the Schuler field still drains to natural watercourses.

The Oil and Gas Commission Factual Data Report #53, Foreword, states in part that water injection rates increased in these three fields during 1948. This is indicated in the following table.

Field	Water injection rate (Barrels per day)	
	1947	1948
Atlanta	1,614	2,346
Magnolia	12,159	13,726
Schuler	3,922	4,048

Reference to brine production and water injection data tabulated in Appendices F-1 to F-4 indicates the trend in net brine discharged to Corney Creek and its tributaries. There was a steady increase in brine production in the Atlanta and Village fields during the five-year period 1944 to 1948 inclusive. It appears that brine from the Magnolia field has been practically all injected into the Reynolds limestone since 1945. Brine injection in the Schuler field has not been complete and approximately 40% of this field lies on Corney Creek drainage basin. Based on the data recorded in Appendices F-1 to F-4, it is evident that brine reaching Corney Creek progressively increased at a very substantial rate through 1948.

Maintenance of Oil Field Properties

Substantial oil stains both within and downstream from these oil fields were evidence of need for improved and more careful operation. A comprehensive survey of producing leases in each oil field would be necessary to accurately appraise maintenance practice. Substantial oil losses may result from inadequate and/or improper control facilities such as tank batteries without firewalls and basal sediment burnpits subject to flooding. Although oil producers aim at certain minimum requirements, it is imperative that water pollution control agencies assist in field inspections to achieve satisfactory lease housekeeping.

Stream and Lake Observations

16. Drainage Basins

Corney Creek drainage basin above Lake Corney extends some 35 miles northwest and varies in width from 10 to 15 miles. A substantial portion of the area is wooded. This section is relatively flat, tending in some areas toward swampland, giving streams with flat gradients. Annual precipitation, based on New Orleans records, may be expected to approximate 55 inches.

A heavy rain occurred the afternoon of July 13 between Little Rock, Arkansas, and Eldorado. Apparently rainfall on Corney Creek drainage basin was light inasmuch as it was not reflected in stream discharge. It is understood that there are no stream gaging stations located on Corney Creek or its tributaries.

17. Three Creeks

Three Creeks receives drainage from the Schuler oil field. This stream was observed at three points, two of which were sampled. Chloride results for these samples are recorded in Appendix H and also appear on the map, Appendix C. Attention is invited to the chloride content of 5770 p.p.m. at Highway No. 15 (Sampling Point #1). The chloride concentration at this point in 1941 was reported as 14,400 p.p.m. (See Appendix D-1).

This is a shallow stream with low banks and a sandy

bottom. At sampling point #9, roughly one mile above confluence with Corney Creek, it was approximately 20 feet wide and 12 inches deep. At this point the water was clear, cypress was growing at the water's edge, and other vegetation was present. Algal growths were observed on the banks and bridge piers at water level at sampling point #1. In the upper reaches, there was no emergent aquatic vegetation. Bass, bream, and top water minnows were seen in the lower half of the stream.

18. Corney Creek

Corney Creek is larger than Three Creeks but otherwise the streams appear to be similar. Discharge at sampling point #2 was estimated by the float method at 20 c.f.s. Samples were collected at four points with chloride results as recorded in Appendix H.

These chloride results are also plotted on the map, Appendix C. These results represent the conditions which existed July 13 and 14, 1949. The chloride concentration of 2065 p.p.m. at sampling point #8 is believed to be of special significance. Considering the normally lower flow in Three Creeks, this chloride value reveals Schuler field to still be a major source of brine. Lake Corney chloride data confirm this assertion.

Gulf Refining Company has a high pressure oil line crossing Corney Creek some two miles above the government reservation in which Lake Corney is located. A break occurred

in this pipe line a short time in advance of this inspection. This accident resulted in a heavy film of oil, typical of fuel oil, above the Highway #115 bridge over Corney Creek (sampling point #9). A scum of oil was blown into windrows along the vegetation bordering the shores in this area. Dissolved oxygen at point #8 was zero near the bottom and 5.2 parts per million just below the surface at 9:30 A.M., July 14. Many dead fish were floating in this section of the stream. Those observed ranged from two-inch bream to five-pound bass. Catfish, bream, and bass were the principal species noticed. Top water minnows were sluggish enough to be caught by hand.

Corney Creek at sampling point #10 is roughly seven miles upstream from the lake and some two miles south of the state line. The stream at this point was estimated to be 40 feet wide and 2 feet deep. The bottom was sandy with practically no bottom growths. The water was slightly turbid. This is one section of Corney Creek in which dead fish were observed early in January, 1949, following a heavy rain. It is believed significant that this observation point is over one mile upstream from confluence with its tributary Three Creeks.

Pigeon Roost Creek was inspected at point #3 as an example of a clean stream in this area and in order to have a basis for evaluating the effect of pollution in nearby streams draining the oil fields. The contrast was striking.

However, some areas in Corney Creek supported an abundance of plant, insect, and fish life. These parameters of clean streams diminished in varying degrees as pollution sources were approached. In fact, tributaries draining the Schuler and Magnolia oil fields had large adjacent areas on each bank completely devoid of vegetation and in some cases the ground was oil-soaked. The banks and bottom of one small tributary, with substantial flow, were saturated with oil. Discharge in this tributary carried oil, and salt was very evident to the taste.

19. Lake Corney

This is an artificial lake created by constructing an earthen dam across Corney Creek near the east edge of Claiborne Parish. This development was a federal project of the Resettlement Administration following the depression of 1933. The reservation containing Lake Corney is now in the charge of the Soil Conservation Service, U. S. Department of Agriculture.

This lake is approximately 1-1/2 miles in length and slightly less than one mile in width at its widest point. It is relatively shallow, being only 27 to 30 feet deep in the old channel a short distence above the dam. The inundated area was not stripped, with the result that the lake edges and shallow areas are marked by a scattering of dead timber.

The lower end of Corney Lake was largely choked with cattail, lotus, water shield, water lily and coontail. Woody and herbaceous vegetation was encroaching from the shore. The upper end supported a growth of rooted emergent aquatic vegetation and mats of dead and dying Myriophyllum. About 90 per cent of the cypress in this part of the lake were dead. It was reported that fishing had steadily declined in this lake and dead fish have been observed on occasion in various portions of the lake. Poor fishing in recent years has been attributed solely to pollution although the lake, at the time of this inspection, was obviously in poor biological condition.

20. Probable Causes for Fish Kills

The waters covered by this investigation presented various conditions from barren to average productivity. The animal life observed in the streams was not always in accord with the appearance of the stream, i.e., fish were observed where the stream banks and bottom were oil-coated. Water samples collected from Lake Corney and contributing streams, prior to and during the inspection, have not shown chloride concentrations sufficiently high to be toxic to fish.

Ogden S. Jones, in quoting from a Bureau of Fisheries report (see reference) states in part that "A transfer of bass and perch from fresh water to a sodium solution con-

taining approximately 14,000 p.p.m., failed to produce any fatalities in 14 days." The opinion is expressed that fish might migrate from slightly saline streams to fresher water, thus resulting in a scarcity of fish in the streams contaminated with oil-field brines. The same report states that when fish die in streams receiving oil-field brine and surface drainage from adjoining oil-producing leases, there is some doubt as to whether the fish were killed by the increased salt concentrations or because of the film of oil which covered the surface of the stream.

There seems to be some correlation between fish destruction in Corney Creek and heavy rainfall on the watershed. It is possible that lethal chloride concentrations could develop in the stream, if brine lagoons are drained rapidly, even though discharge may be above normal. Increased discharge of petroleum wastes from oil-producing leases during and following heavy rains may be of even greater significance. Crystallized salt is another source of chlorides appearing in storm runoff from oil fields.

The importance of promptly investigating stream conditions following a fish kill cannot be overemphasized. Subsequent investigations, though possibly more detailed, leave something to be desired. It is unfortunate that studies of Corney Creek have not been made, in the past, at the time of or immediately following mass fish kills.

Summary and Conclusions

The information contained in this report serves as basis for the following tentative conclusions:

1. Indications are that brine is a contributing factor to pollution of Corney Creek during certain seasons.

2. The records do not show chloride concentrations in these waters which would be expected to directly injure fish, although stratification in Corney Lake may interfere with normal feeding and propagation.

3. Water injection into subsurface strata, in Schuler, Magnolia, and Atlanta oil fields, constitutes a major contribution to the solution of this brine disposal problem.

4. Water injection in the Atlanta field is too recent to evaluate its beneficial effect on the stream.

5. The Oil and Gas Commission, because of its extended and intimate professional contact with the Arkansas oil producers, is the logical agency to promote a brine injection system for the Village field.

6. Schuler field continues as a significant source of brine through discharge to Three Creeks, a tributary of Corney Creek.

7. Water injection into subsurface strata, in the oil fields located on Corney Creek drainage basin, failed to offset increased brine production during the five-year period 1944 to 1948, inclusive, and, as a result, net oilfield brine for surface disposal has increased.

8. There appears to be some correlation between heavy rainfall on the Corney Creek watershed and mass fish kills in this stream, especially when preceded by a long dry spell.

9. Dead fish observed at sampling point No. 8, Highway No. 115 bridge, July 14, were undoubtedly killed either directly by the oil or by oxygen deficiency, from reduced reaeration, as a result of the heavy oil film.

10. Current scarcity of game fish in Corney Lake may be attributed, in part, to excessive vegetation.

11. Decomposition of organic material and respiration of aquatic plants may disturb the oxygen balance in the shallow portions of Corney Lake to the point of occasionally causing oxygen deficienty.

12. Toxic substances, other than chlorides, may well be contained in surface drainage from the oil-producing leases in sufficient quantities to kill fish in Corney Creek.

Acknowledgments

It is desired to acknowledge the valuable assistence of Arkansas State officials who co-operated in making this field investigation. Records of the Louisiana Stream Control Commission are considered a valuable appendix to this report. Special thanks are due Biologists Fields and Macley who were most helpful in evaluating degrees of pollution through identification of aquatic plants and fish species.

Reference Material

1. Secondary Recovery of Petroleum in Arkansas - A Survey. A report prepared under the auspices of the Arkansas Oil and Gas Commission - Prepared by Professor G. H. Faneher and Senior Geologist D. K. Mackay

2. Factual Data #53, Engineers Report of Oil and Gas Reservoirs Under State Control, through 1948, Compiled by Arkansas Oil and Gas Commission.

3. "Petroleum - Engineering Study of Atlanta Oil Field, Columbia County, Ark." Bureau of Mines Report of Investigations R. I. 4455, June, 1949.

4. "Disposition of Oil Field Brines" by Ogden S. Jones, Geologist, Kansas State Board of Health, pages 165 and 166.

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CORNEY CREEK AND LAKE CORNEY
SOUTHERN ARKANSAS - NORTHERN LOUISIANA
July 13 and 14, 1949

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(Copy)

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
Washington, D. C.

May 24, 1949

Mr. Albert M. Day, Director
Fish & Wildlife Service
U.S.Department of the Interior
Washington 25, D.C.

Dear Mr. Day:

I am in receipt of a letter from Mr. C. W. James, Ruston, Louisiana, in which he expresses grave concern over the increased amounts of oil field waste which is being turned into Corney Creek from the Village Field, Columbia County, Arkansas, oil producing area.

Corney Creek rises in South Arkansas and flows through Claiborne and Union Parishes in North Louisiana and flows in D'Arbonne at Farmerville and into the Ouachita River at Monroe, Louisiana. Near Bernice,La.,there is a very popular lake which goes by the name of Corney Lake and is a federal project. This lake is fed by Corney Cr

According to the information I have, five hundred thousand gallons of salt water is being poured into Corney Creek daily from the above-mentioned oil field in Columbia County, Arkansas. I am informed that this salt water pollution showed sixty per cent increase in 1948 over 1947 and that many fish above Corney Lake were killed by the salt water pollution. In view of the increase in pollution it is feared that the entire stream to the Ouachita River will be ruined for fishing.

Interested residents have taken the matter up with the Louisiana Conservation Commission but they have no control over pollution originating in Arkansas. The matter has also been taken up with the Arkansas Game and Fish Commission where the reaction appeared to be sympathetic; however, the damage is all in the State of Louisiana as the stream is not of sufficient size in Arkansas to be of any value. I was further advised that investigation has revealed that this salt water is being dumped directly on the ground in practically all cases with little or no attempt being made to retain the waste in ponds or to otherwise control its disposal.

In view of the many requests that I have received for assistance in correcting this very adverse situation, I will greatly appreciate your usual cooperation in causing an investigation to be made with the view of controlling pollution at Corney Creek. In event this matter does not lie within the scope of your Organization, then I will appreciate any suggestions that you might offer which would provide for correction of Corney Creek pollution.

With kindest regards and best wishes, I remain

Sincerely yours ,

/s/ Otto E. Passman
Member of Congress

(Copy)

U. S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Washington

June 6, 1949

Hon. Otto E. Passman
House of Representatives

My dear Mr. Passman:

This will acknowledge receipt of your letter, dated May 24, 1949, requesting investigation and suggestions for the alleviation of the pollution by oil field wastes of Corney Creek, Arkansas and Louisiana. Copy of your letter is being forwarded to the Regional Office of this Service in Atlanta, Georgia, with a request that such reconnaissance investigation, as limitations of funds and personnel will allow, be made of the effects of this pollution on fish and wildlife resources.

Although the Fish and Wildlife Service is gravely concerned about the impairment of natural resources by pollutants, it has neither the organization nor the authority to instigate reform. Control of pollution is primarily a responsibility and right of the State. However, in enacting the Water Pollution Control Act (Public Law 845) last year, Congress provided for a modicum of Federal responsibility for comprehensive water pollution control under the divided administration of the Public Health Service of the Federal Security Agency and the Federal Works Agency.

The pollution of Corney Creek which involves interstate water may well be a problem to be handled under the provisions of the new Water Pollution Control Act. We are therefore suggesting that our regional biologists discuss this possible approach with personnel of the Atlanta office of the Public Health Service.

Sincerely yours,

/s/ Albert M. Day
Director

(Copy)

June 16, 1949

Honorable Otto E. Passman
Member of Congress
House Office Building
Washington, D. C.

Dear Congressman:

Commissioner Clements has sent me copies of your letter to Albert M. Day, Director of the United States Fish & Wild Life Service and Mr. Day's report to you, the letters dealing with the pollution of Corney Creek by oil field brines originating in the State of Arkansas.

While I was at the United States Public Health Service School for Sanitary Engineers at Cincinnati during the last week of April of this year, I had a detailed discussion of this matter with Mr. F. L. McDonald, Chief Sanitary Engineer of the Arkansas Board of Health and with Mr. Hayse H. Black, Sanitary Engineer of the United States Public Health Service. At that time I told both Mr. McDonald and Mr. Black that the pollution of Corney Creek was a very serious matter and that some steps would have to be taken to clear up the pollution. I have also been in touch with Mr. Joe Hogan of the Arkansas Fish & Game Commission and have sent him copies of the various letters pertaining to this matter. In the meantime the Commissioner received a letter from the United States Soil Conservation Service containing analyses of water samples, said samples being taken at various spots along Corney Creek both in Arkansas and Louisiana and at Corney Lake. These samples indicate that the pollution is continuing and will probably get worse as the dry summer season approaches.

I note that Mr. Day has stated that his biologist in Atlanta will consult with the Public Health Service regarding this matter. As Mr. Day says the State of Louisiana is powerless in this matter and only the Public Health Service acting under provisions of Public Law 845 can do anything about the conditions complained of. I have been hoping that the Arkansas authorities would see fit to require the oil operators who are presently disposing of their brine into Corney Creek drainage area to dispose of all brine through disposal wells.

I would be more than pleased to give you any additional information that you may deem necessary in regard to this matter.

Yours very truly,
STREAM CONTROL COMMISSION (Louisiana)
/s/ Frank J. Coogan, Technical Adviser

FJC:by
cc: Commissioner Clements
Mr. Albert M. Day; Mr. McDonald
Mr. Hayse H. Black; Mr. M. A. Krotts, Ruston, La.

(Copy)

U. S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Office of Regional Director
Glenn Building, Atlanta 3, Georgia

June 17, 1949

Mr. Frank Tetzlaff, Sanitary Engineer
Chief, Engineering Division
U. S. Public Health Service
Atlanta 3, Georgia

Dear Mr. Tetzlaff:

Our office has been requested to make a reconnaissance survey of the effects of reported oil field waste pollution of Corney Creek, Arkansas and Louisiana. Copies of correspondence leading to this request from Congressman Otto E. Passman, dated May 24, 1949, and Director Albert M. Day's reply, dated June 6, are enclosed for your information. Copies of these letters were submitted to the Director of Water Pollution Control, Public Health Service, Washington, D.C., by our Washington Office.

Recently, Mr. Fredine and Mr. Travis S. Roberts of this Service discussed this matter with Mr. Carl Harper, Regional Attorney, Federal Security Agency. He advised that the River Basin Pollution Study Office of the Public Health Service covering this area has not been established as yet, and he suggested that we refer the matter to you. This appears to be a case which clearly comes under the Water Pollution Control Act, Public Law 845, especially in that it involves interstate water.

We intend to ask Mr. Travis S. Roberts, Aquatic Biologist, In Charge Vicksburg Suboffice, River Basin Studies, to make a reconnaissance survey for this Service. We will be pleased to report our findings to you and are particularly interested in cooperating with the Public Health Service in consideration of this matter. Any suggestions you may have as to participation by the U. S. Public Health Service will be sincerely appreciated.

Very truly yours,

/s/ Walter A. Gresh
Acting Regional Director.

G. P. No. 96

TO: Mr. Frank J. Coogan
FROM: Mr. William B. Bowers
SUBJECT: Motor boat trip and collection of samples on Corney Lake and Big Corney Creek.

Sportsmen in Haynesville and Homer, Claiborne Parish, are complaining bitterly about the condition of Corney Lake and the absence of good fishing, stating that this condition is caused by the pollution of Big Corney Creek by brine from Atlanta and Schuyler Oil Fields in Arkansas.

A letter was written by T. L. James of Ruston, La., to John Thomas, local sportsman, Haynesville, La., requesting a concentrated effort on the part of interested citizens to stop this pollution, suggesting the use of the recently passed bill by the 80th Congress, also stating that Mr. Otto Passman from the Fifth Congressional District has been approached on this subject. Mr. James also revealed in his letter how many barrels per day was coming from these fields. Sportsmen are also complaining of an overgrowth of water lilies and other aquatic plant growth as taking the lake, as they express it. Water samples were taken at random spots over the lake and up Big Corney Creek for Na/Cl. This sampling will be repeated every thirty days throughout the summer and fall.

(Copy) Appendix B-6

31.

OTTO E. PASSMAN
5th DIST., Louisiana

Julian P. Langston
Secretary
Washington Office:
1018 House Office Bldg.
Home Office:
120 Walnut St., Monroe, La.

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D. C.

COMMITTEE:
APPROPRIATIONS

SUBCOMMITTEE:
TREASURY
POST OFFICE

June 21, 1949

Dr. Leonard A. Scheele, Surgeon General
U.S. Public Health Service
Federal Security Bldg., Washington 25, D.C.

Dear Dr. Scheele:

I am in receipt of several letters from constituents residing in northeast Louisiana in which grave concern is expressed over increased amounts of oil field wastes which are being turned into Corney Creek from Village Field, Columbia Co., Arkansas, oil producing area.

Corney Creek arises in South Arkansas and flows through Claiborne and Union Parishes in North Louisiana into D'Arbonne at Farmerville and thence into the Ouachita River at Monroe, Louisiana. Near Bernice, Louisiana, is the very popular Corney Lake which is a federal project. This lake is fed by Corney Creek.

According to the information I have, five hundred thousand gallons of salt water is being poured into Corney Creek daily from the above-mentioned oil field in Columbia County, Arkansas. I am informed that this salt water pollution showed a sixty per cent increase in 1948 over 1947 and that many fish above Corney Lake were killed by the salt water pollution. In view of the increase in pollution it is felt that the entire stream to the Ouachita River will become a menace to public health and will also be ruined as a fishing stream.

The matter has been discussed with Mr. Albert M. Day, Director, United States Fish and Wildlife Service, who has stated that his biologist at Atlanta, Georgia, will consult with Public Health Service officials regarding this matter. I believe that this matter has also been brought to the attention of Mr. Hayse H. Black, Sanitary Engineer of the United States Public Health Service, to the attention of Mr. F. L. McDonald, Chief Sanitary Engineer of the Arkansas Board of Health, and to the attention of Mr. Frank J. Coogan, Technical Adviser, Stream Control Commission of the State of Louisiana. It is the hope of all interested parties that through the provisions of the Water Pollution Control Act (Public Law 845) that the federal government through the Public Health Service will be able to take steps to correct the pollution of Corney Creek. I can assure you that whatever your office can do in this matter will be appreciated by the many residents of North Louisiana who enjoy the recreational facilities of Corney Creek and Corney Lake and by the many public officials whose responsibility it is to assist in seeing that the best interests of the Public are fully protected.

With kindest regards and best wishes, I remain,

Sincerely yours,
OTTO E. PASSMAN, Member of Congress

July 1, 1949

Dear Mr. Passman:

I have your recent letter to Doctor Scheele, who is in Rome, Italy, attending the Second World Health Conference. In this letter you expressed concern over the pollution of Corney Creek by oil field wastes from the Columbia County oil producing area.

As you know, this problem has already come to our attention, through a report from our Communicable Disease Center at Atlanta to our Division of Water Pollution Control. You will be pleased, I am sure, to learn that arrangements are already under way for a preliminary field survey of the problem by personnel from our Environmental Health Center, Cincinnati, Ohio, and the biologist from the U. S. Fish and Wildlife Service. They will, of course, work closely with Mr. F. L. McDonald, Chief Sanitary Engineer of the Arkansas Board of Health a nd Mr. Frank J. Coogan, Technical Adviser, Stream Control Commission of the State of Louisiana.

Thank you for your interest in this problem. We shall be glad to let you know the developments.

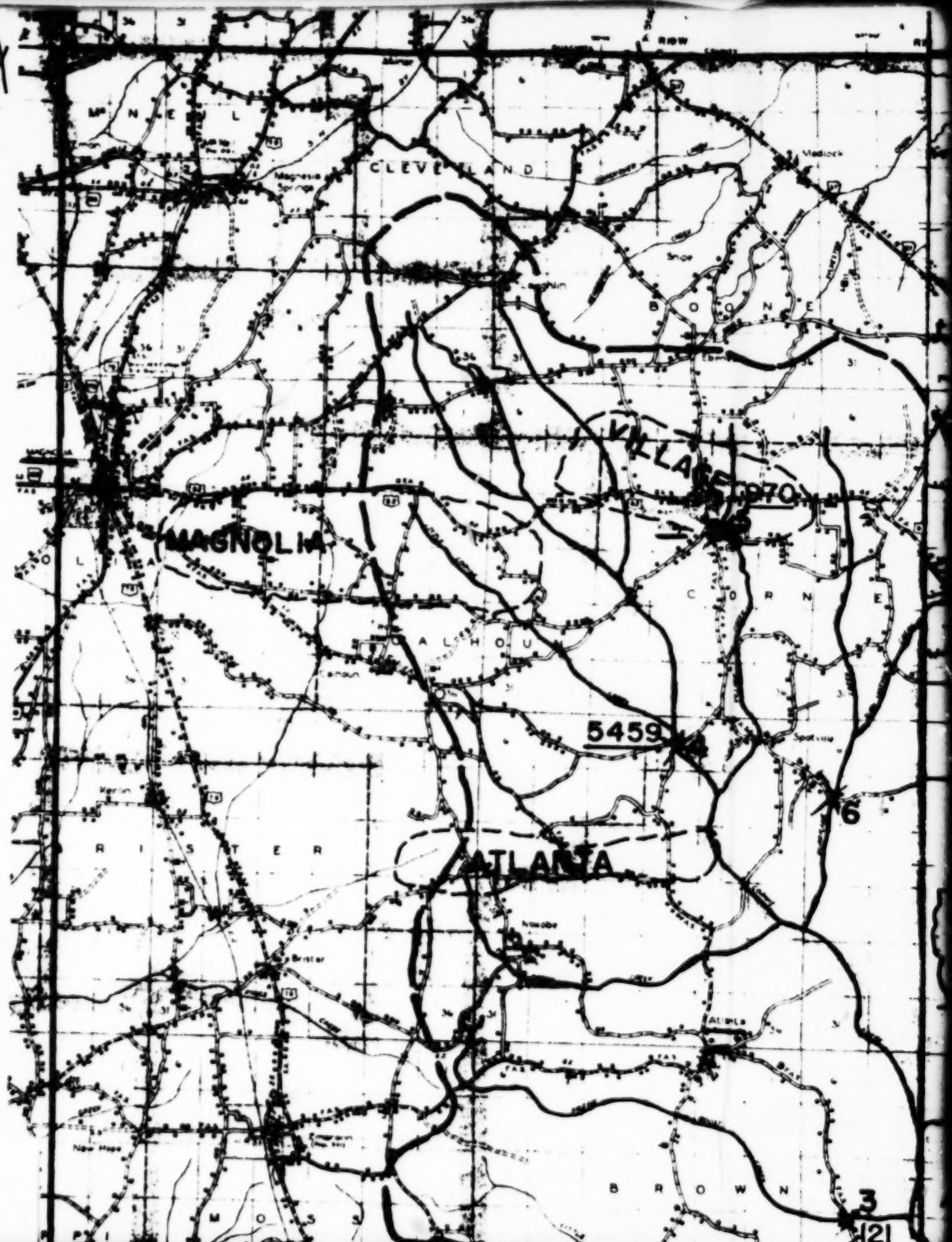
Sincerely yours,

/s/

Acting Surgeon General

Honorable Otto E. Passman
House of Representatives
Washington, D. C.

cc: Environmental Health Center
with cc. of inc.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CLEVELAND
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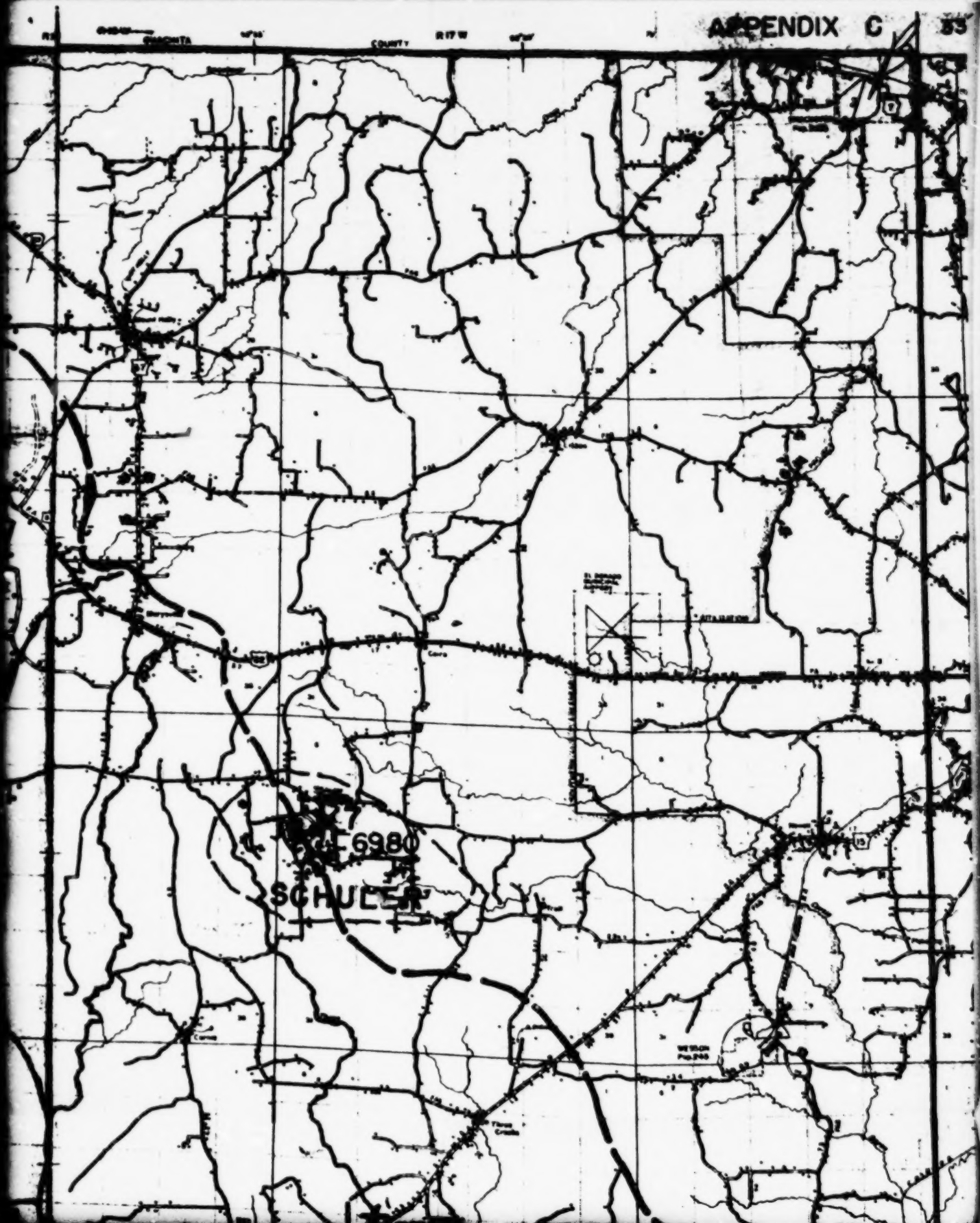
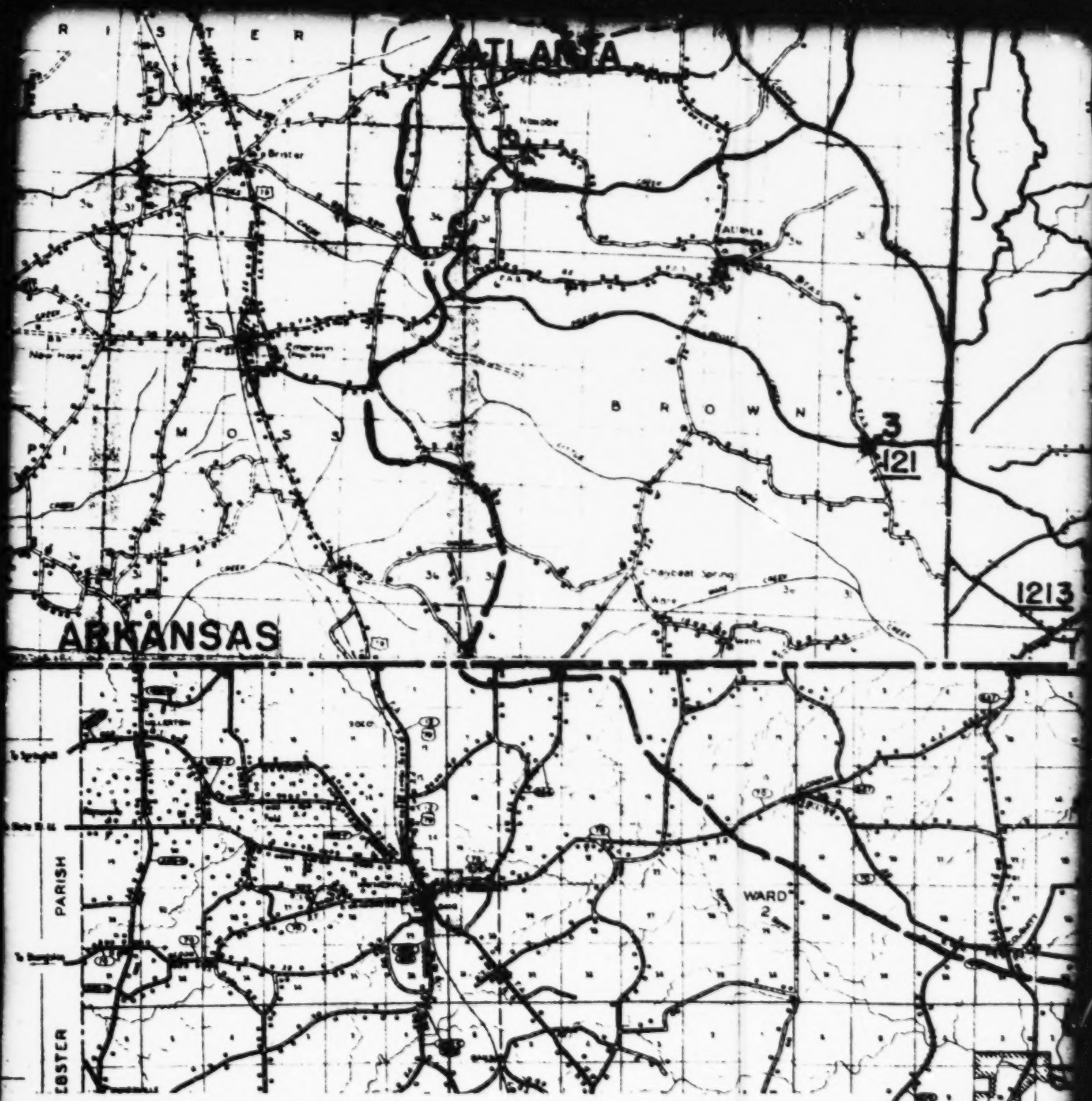
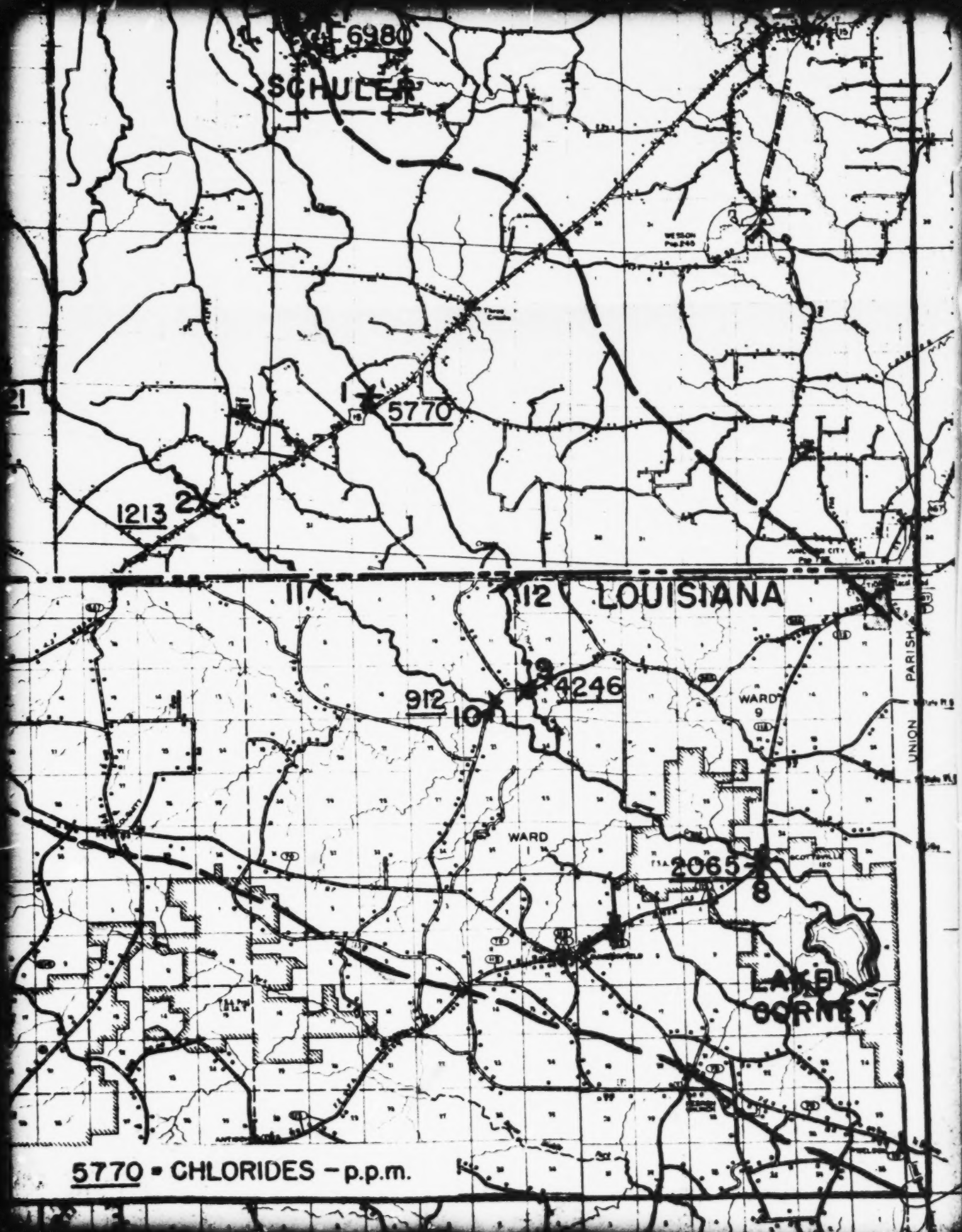
121


6980
SCHULER



CORNEY CREEK
DRAINAGE BASIN ABOVE LAKE CORNEY
SHOWING OIL FIELDS AND
STREAM SAMPLING POINTS
JULY 1949


6980
SCHULER
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5770 = CHLORIDES – p.p.m.

DEPARTMENT OF CONSERVATION
Division of Research and Statistics
August 20, 1941

G.P. 96.1, Corney Bayou
Claiborne Parish, Salt Water Pollution

Investigation by: Thomas M. Logan, Civil Engineer
Date of Investigation: August 1, 1941

Salt water pollution of Corney Bayou was traced to the Schuler Oil Field in Union County, Ark. Conductivity readings and a sample (W.A.61) were taken at a point where Corney Bayou crosses Louisiana State Highway No.115. The reading at this point was used as a basis of comparison, and was 459.3. The readings were not reduced to p.p.m. of chlorides in the field.

Inspection was continued from Junction City by Louisiana State Highway 565 to Colquitt. The streams crossed were as follows:

Stream	Sample	Reading
Franks Creek	No sample taken	58.5
Three Creeks	W. A. 62	8243.5
Corney Bayou	W. A. 63	160.7

These readings definitely established Three Creeks as the stream through which salt water reaches Corney Bayou.

At points where the two branches of Three Creeks cross Arkansas State Highway No. 15, readings were as follows:

Stream	Sample	Reading
West branch of Three Creeks	W.A.64	21,433
East branch of Three Creeks	W.A.65	21,433

At the town of Three Creeks, Ark., approximately one mile from the location of sample W.A.65, Mr. C.W. Adams stated that after rains a great many fish die in the two branches of Three Creeks.

At points where the two branches of Three Creeks cross dirt road just north of Schuler Oil Field, the branches were dry. At crossings on dirt road in north section of Schuler Field, water in the branches was stagnant. At location of sample W.A.66, see map, a salt water stream ran into a swamp area formed by it, and the two branches of Three Creeks. Four pictures were taken at this location showing swamp area at roadway, dead timber, and salt crystallization There was considerable crystallized salt visible throughout the swamp area, which would go back into solution during rains and increase the normal concentration of salt in the stream.

P.p.m. of chlorides in samples analyzed in the laboratory are as follows:

Sample	P.p.m. Chlorides
W. A. 61	218
W. A. 62	5,280
W. A. 63	72
W. A. 64	14,400
W. A. 65	14,400
W. A. 66	14,400

Submitted by,

THOMAS M. LOGAN

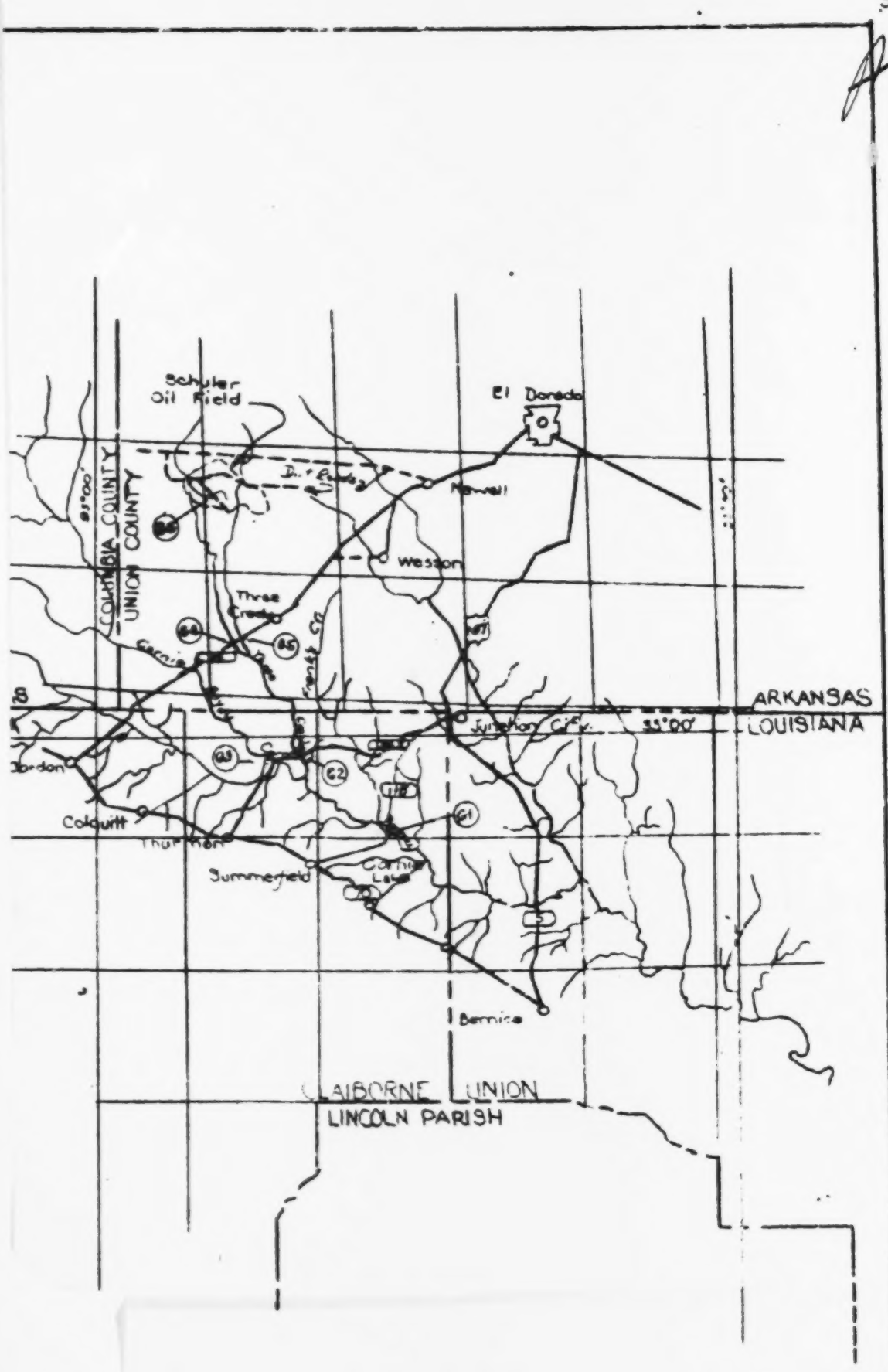
Civil Engineer

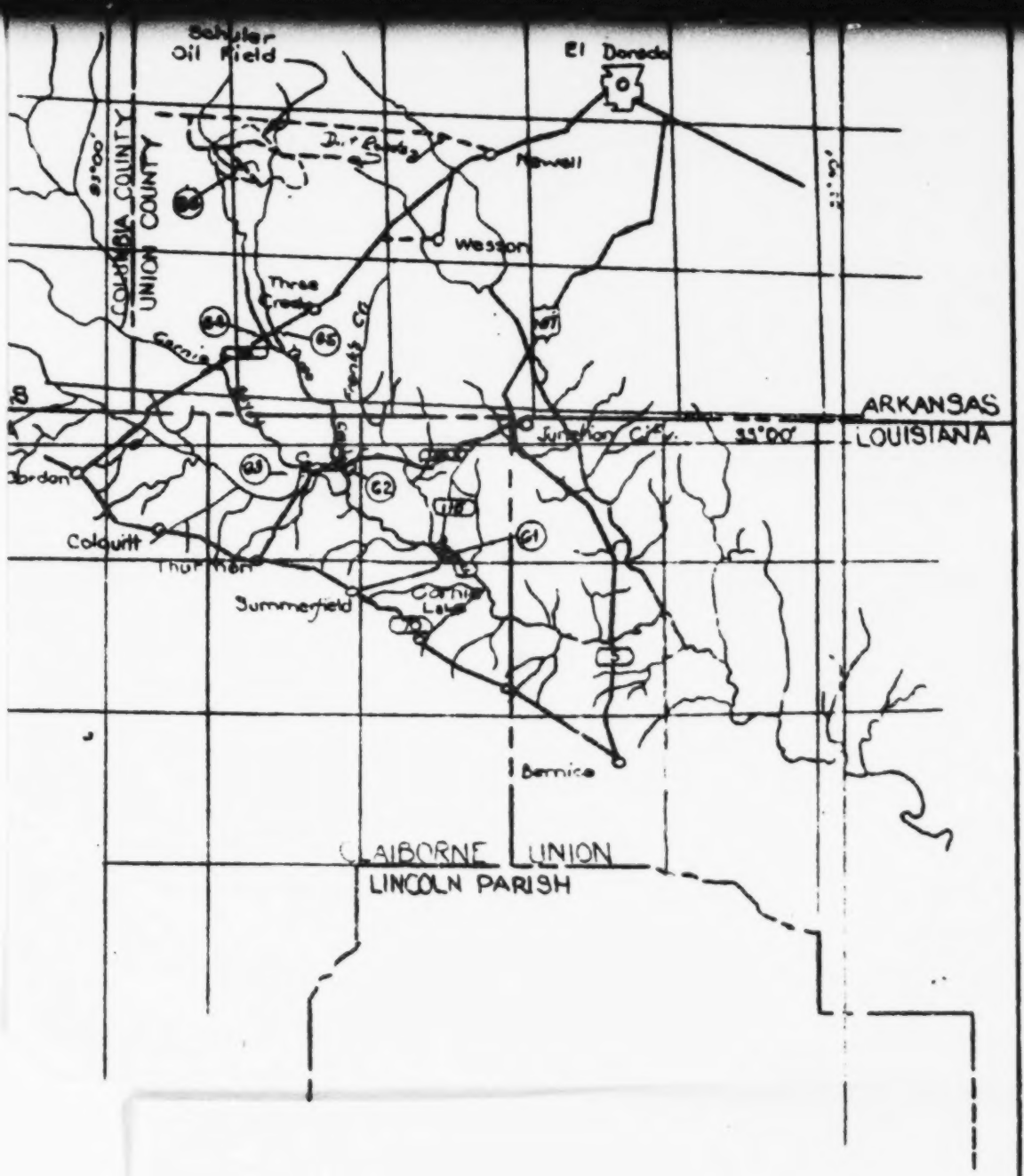
Attached: 1 map

Approved:

W. F. CHISHOLM

Director


Schuler
Oil Field
El Dorado
Norwell
Wesson
Three Creeks
Garcia
Jordan
Colquitt
Thurman
Summerfield
Bernice
Junction City
ARKANSAS
LOUISIANA
COLUMBIA COUNTY
UNION COUNTY
CLAIBORNE
UNION
LINCOLN PARISH
82
61
167
15
28


Sabine
Oil Field
El Dorado
Haynesville
Weston
Three Creeks
Cotton Valley
Cecil
Junction City
ARKANSAS
LOUISIANA
Jordon
Colquitt
Thurman
Summerfield
Corrine Lake
Bernice
CLAIBORNE UNION
LINCOLN PARISH
COLUMBIA COUNTY
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DEPARTMENT OF CONSERVATION
Division of Research & Statistics
September 15, 1941

G.P. 96.2
Corney Lake
Claiborne Parish
Salt Water Pollution
Field report

Investigation by: Thomas M. Logan, Civil Engineer

Date of Investigation: August 22, 1941.

A survey of Corney Lake was made by Mr. T. M. Logan, Civil Engineer, and J. B. Percheud, Chemical Engineer of the Division of Research and Statistics, and L. C. Andrews, Chemist of the Louisiana State Board of Health, at the request of Mr. Herbert Watkins of the Claiborne Parish Police Jury and Mr. Melton Oakes of the Homer National Bank.

A series of depth samples were taken at various points in the lake located as shown on map. All samples were taken in triplicate, two of which were sealed and the third used to make a composite. Sample numbers, depths and chlorides as indicated by conductivity readings are as follows:

SAMPLE NO.	DEPTH	CHLORIDES BY CONDUCTIVITY (p.p.m.)
*W.A. 185	12 ft.	255
W.A. 186	6 ft.	105
W.A. 187	1 inch	105
*W.A. 188	5 ft.	105
W.A. 189	1 inch	105
*W.A. 190	14 ft.	225
W.A. 191	7 ft.	220
W.A. 192	1 inch	105
*W.A. 193	4 ft.	94
W.A. 194	1 inch	94
*W.A. 195	5 ft.	400
W.A. 196	1 inch	380

*Note: These samples were taken 1 foot off bottom.

W.A. 197 was taken in Three Creeks at bridge crossing near residence of Mr.R.H.Hodges. Chlorides by conductivity were 2,900 p.p.m.

W.A.198 was taken in Corney Bayou above entrance of Three Creeks. Chlorides by conductivity were 96 p.p.m.

A temporary earth dam has been built above the spillway, which was being repaired, and as a result there was no flow of water from the lake. Considerable stratification of the water was noted in the conductivity readings, and also in the color of the samples at different depths. The samples obtained near the surface were clear and those near the bottom were amber.

Submitted by:

THOMAS M. LOGAN

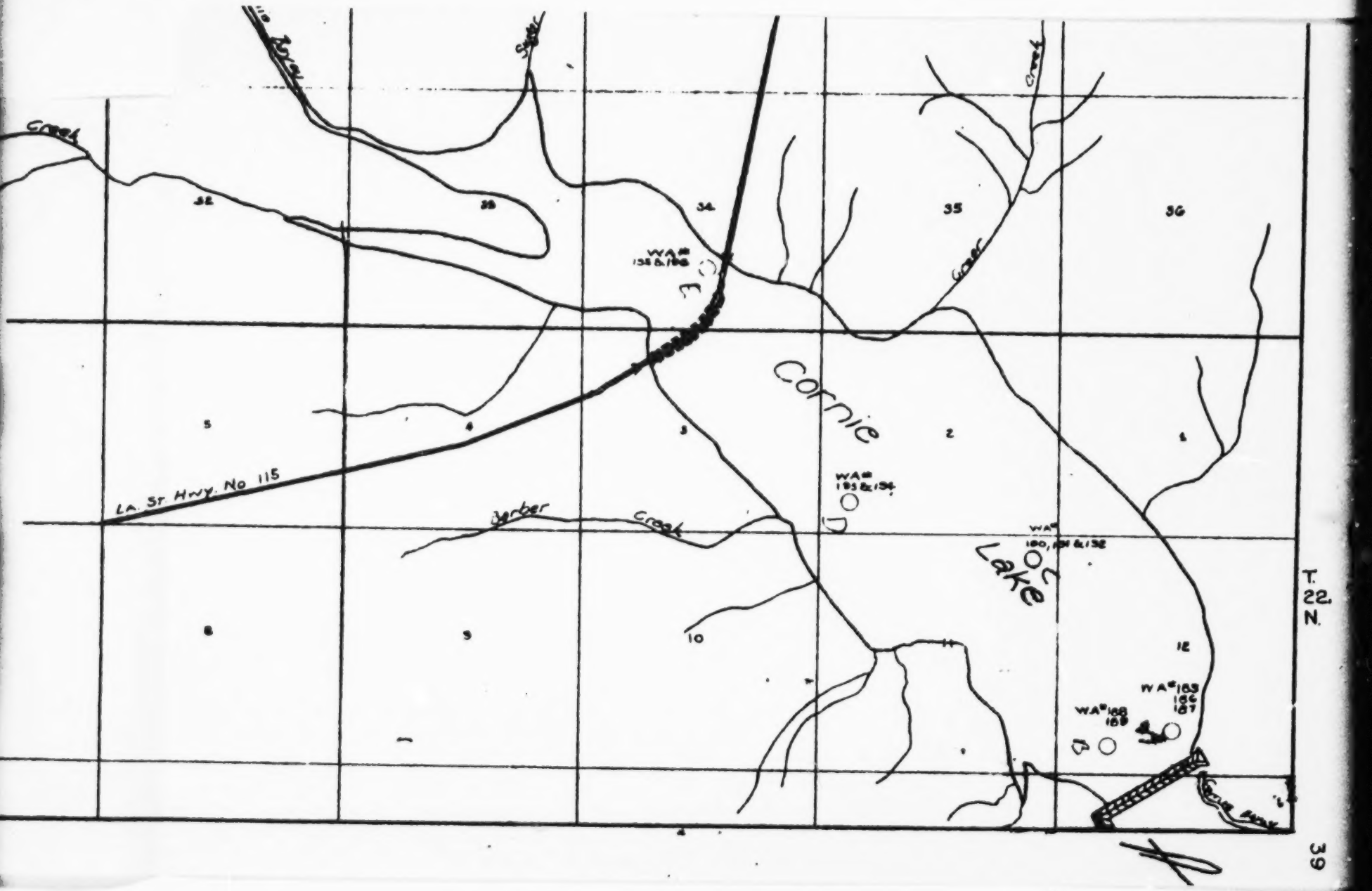
Civil Engineer.

Attached: 1 map.

Approved:

W. F. CHISHOLM

Director


Creek
32
33
34
35
36
WA 131 & 133
Corrie
Lake
LA. ST HWY. No 115
Barber Creek
WA 133 & 134
WA 100, 101 & 132
WA 183
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WA 188
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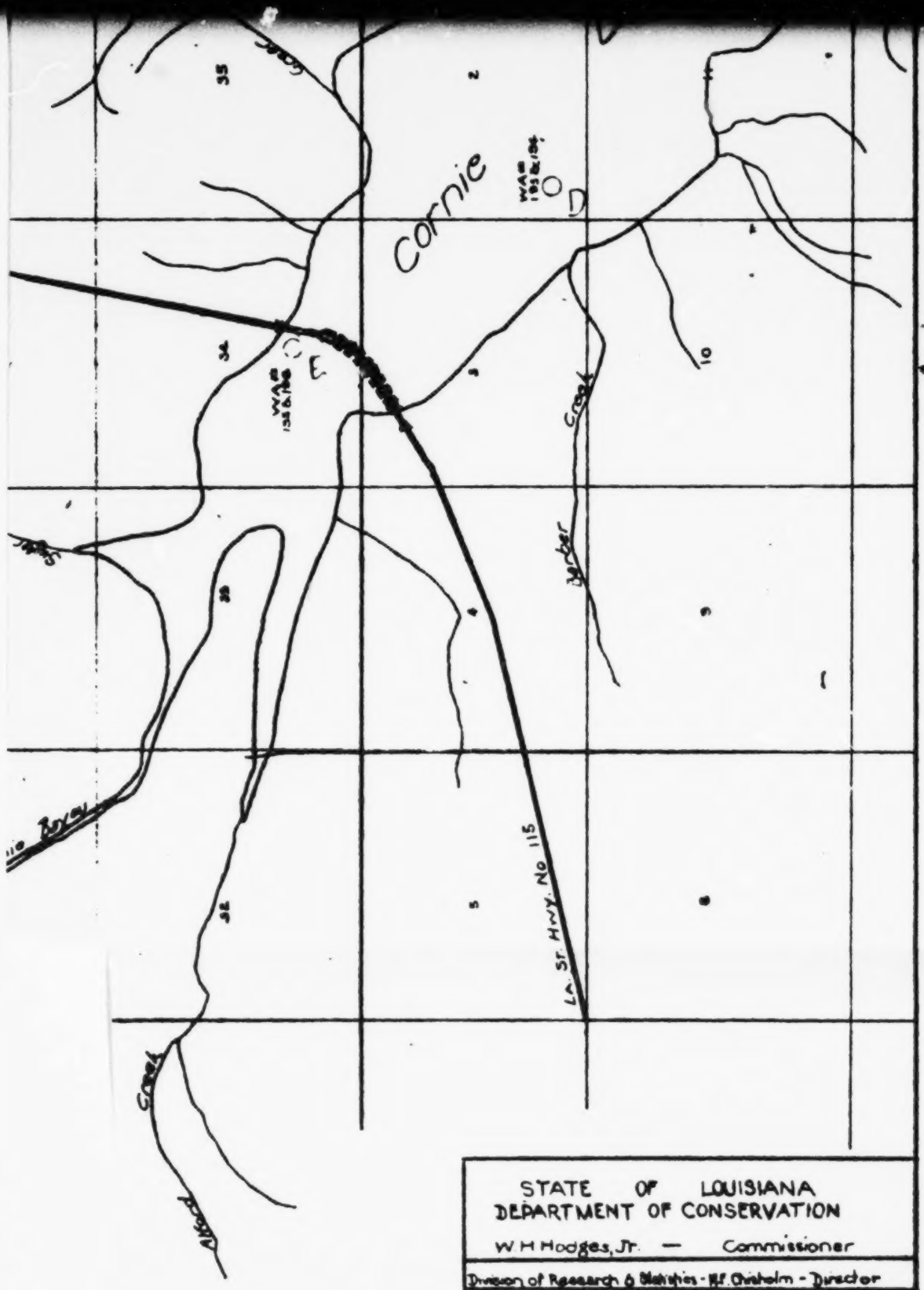

STATE OF LOUISIANA
DEPARTMENT OF CONSERVATION

W H Hodges, Jr. — Commissioner

Division of Research & Statistics - H.F. Chisholm - Director

POLLUTION STUDY OF CORNIE LAKE

Sampling Stations
Scale 1" = 2640'

Drawn	Traced	Checked	Approved	Date	File No
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B

DEPARTMENT OF CONSERVATION
Division of Research & Statistics
September 29, 1941

G.P. 96.3
Corney Lake,
Brine Pollution.

THE CONCENTRATION OF CHLORIDES IN CORNEY LAKE

Date of Investigation: August 23, 1941.

By: Louis Cusachs, Chemical Engineer.

Samples of water from Corney Lake, collected by Messrs. T. M. Logan and J. B. Ferchaud, of the Division of Research and Statistics, and Mr. L. C. Andrews, of the Louisiana State Board of Health, were received with unbroken seals over the caps of the bottles. The samples were brought to the laboratory of the Division of Research and Statistics, and chloride determinations were made by the writer on August 23, 1941, the same day the samples reached Baton Rouge.

On the following day, Messrs. Logan, Ferchaud, and Andrews brought the duplicates of the samples shipped to Baton Rouge to the Division laboratory. After Mr. Andrews had verified the standardization of the reagent, he made chloride determinations on the duplicate samples.

Portions of the samples, taken at the Dam, up the lake, and the composite, were delivered personally to Dr. M. C. Schwartz, of the Department of Chemical Engineering and of the Engineering Experiment Station of Louisiana State University. Dr. Schwartz is a member of the Editorial Committee for the publication of the Standard Methods for the Examination of Water and Sewage, which is sponsored jointly by the American Public Health Association and the American Water Works Association.

In some laboratories, concerned with water for municipal supply, the determinations are reported in terms of the chloride radicle. In other laboratories dealing specifically with boiler feed water the results are expressed in terms of sodium chloride. The following results are expressed both as chlorides and as sodium chloride.

The tabulated results show, on the whole, consistent results with no marked divergence between the determinations by the individual analysts. The seemingly wide difference in the values for F (W.F 198) samples is due to the necessity of diluting the original sample. To express the chloride concentrations on the basis of the original samples the determined values are multiplied by 500.

Thus an analytical divergence of only two tenths (0.2) of one part per million became 100 parts per million on the original sample. Other analytical procedures are required for closer results for high concentrations of chloride.

The data, presented here, show clearly the "stratification" of the water in Corney Lake at the time the samples were taken. The water at the bottom of the lake is more deeply colored, especially at the dam. In the C. group of samples (W.A. 190, 191, and 192), the sample taken at an intermediate depth contains more chloride than the sample taken from the bottom of the lake. The apperent density of the samples shows a value of 0.9966 for the bottom sample, against 0.9958 for the sample at an intermediate depth. In other words, the density of the water is not established solely by the chloride concentration.

The importance of correct sampling is well illustrated. The composite sample from the lake has a concentration of some 143 parts per million of chlorides, at the time the samples were taken. This value cannot be approximated by any of the surface samples. The arithmetical mean of the separate determinations is 148 p.p.m. as chlorides.

The chloride concentration of Corney Lake as a whole is thus approximately 145 p.p.m. with variations from 83 to 373 p.p.m. of chloride at different locations and depths.

For comparison with the lake water proper, samples from Three Creeks have 2,875 p.p.m. of chloride and from Corney Bayou show 82 p.p.m. of chloride.

Submitted by:

LOUIS CUSACHS

Chemical Engineer

Approved:

W. F. CHISHOLM

Director.

Attached: Schedule A.

SCHEDULE A - DETERMINATIONS OF CHLORIDE IN WATER SAMPLES FROM CORNEY LAKE Date: August 22, 1941.

Sample number	W.A. No.	Description of sample	Chloride	As sodium chloride	Analyst
A-1	185	At Dam, 12 ft. depth . . .	133	218*	M.C.Schwartz
A-1	185	At Dam, 12 ft. depth . . .	138	228	L.Cusachs
A-2	185	At Dam, 12 ft. depth . . .	138	228	L.C.Andrews
A-3	186	At Dam, 6 ft. depth	84	137*	M.C.Schwartz
A-3	186	At Dam, 6 ft. depth	89	147	L.Cusachs
A-4	186	At Dam, 6 ft. depth	91	150	L.C.Andrews
A-5	187	At Dam, 1 in. depth	83	136*	M.C.Schwartz
A-5	187	At Dam, 1 in. depth	87	144	L.Cusachs
A-6	187	At Dam, 1 in. depth	89	147	L.C.Andrews
B-1	188	At center of lake, bet.spillway and camp, 5 ft.depth .	87	144	L.Cusachs
B-2	188	At center of lake, bet.spillway and camp, 5 ft.depth .	89	147	L.C.Andrews
B-3	189	At center of lake, bet.spillway and camp, 1 in.depth .	87	144	L.Cusachs
B-4	189	At center of lake, bet.spillway and camp, 1 in.depth .	88	145	L.C.Andrews
C-1	190	Due N. of boathouse, 1¼ mile above dam, 14 ft. depth .	134	220*	M.C.Schwartz
C-1	190	Due N. of boathouse, 1¼ mile above dam, 14 ft. depth .	141	233	L.Cusachs
C-2	190	Due N. of boathouse, 1¼ mile above dam, 14 ft. depth .	142	234	L.C.Andrews
C-3	191	Due N. of boathouse, 1¼ mile above dam, 7 ft. depth . .	165	270*	M.C.Schwartz
C-3	191	Due N. of boathouse, 1¼ mile above dam, 7 ft. depth . .	172	284	L.Cusachs
C-4	191	Due N. of boathouse, 1¼ mile above dam, 7 ft. depth . .	180	297	L.C.Andrews
C-5	192	Due N. of boathouse, 1¼ mile above dam, 1 in. depth . .	88	145	L.Cusachs
C-6	192	Due N. of boathouse, 1¼ mile above dam, 1 in. depth . .	90	149	L.C.Andrews
D-1	193	2½ miles above dam, 4 ft.depth	80	142	L.Cusachs
D-2	193	2½ miles above dam, 4 ft.depth	83	137	L.C.Andrews
D-3	194	2½ miles above dam, 1 in.depth	81	134	L.Cusachs
D-4	194	2½ miles above dam, 1 in.depth	83	137	L.C.Andrews
E-1	195	At bridge, Hwy.115, 5 ft.depth	375	619	L.Cusachs
E-2	195	At bridge, Hwy.115, 5 ft.depth	370	611	L.C.Andrews
E-3	196	At bridge, Hwy.115, 1 in.depth	348	574	L.Cusachs
E-4	196	At bridge, Hwy.115, 1 in.depth	347	573	L.C.Andrews
---	199	Composite of lake	140	230	M.C.Schwartz
---	199	Composite of lake	143	236	Andrews & Cusachs
F-1	197	Three Creeks, at bridge near home of R. H. Hodges . . .	2825	4660#	L.Cusachs
F-2	197	Three Creeks, at bridge near home of R. H. Hodges . . .	2925	4826#	L.C.Andrews
G-1	198	Corney Bayou, at bridge . .	80	132	L.Cusachs
G-2	198	Corney Bayou, at bridge . .	83	137	L.C.Andrews

Note: * Reported as Sodium Chloride, values converted to chloride.
Dilution factor of 500; divergence of 0.2 p.p.m. of chloride between determinations.

DEPARTMENT OF CONSERVATION
Division of Research and Statistics
May 4, 1943

G.P. 96.4
Corney Lake
Claiborne Parish

Report of investigation of the salt content of water in Corney Lake, April 14, 1943.

By: Dr. Peter Doudoroff, Biologist and Mamie T. LoSavio, Chemist.

The concentration of chlorides in Corney Lake, Claiborne Parish, has been repeatedly investigated by this Division from June to August, 1941, and the results have been reported fully (H 1.1, 1.2; G.P. 96.1, 96.2, 96.3). These investigations were undertaken chiefly in connection with the problem of the suitability of the waters of North Louisiana lakes for industrial use. An unusually high concentration of chlorides was found in the Corney Lake water at that time, and it was found that the chief source of the salt was the Schuler Oil Field in Union County, Arkansas, from which discharged oil-field brine reached Corney Lake through Three Creeks, a tributary of Corney Bayou. The biological aspects of the problem had not been given consideration in the above reports.

More recently some concern has been expressed by interested parties about the possible effect of the contamination of Corney Lake water with brine upon fish and other aquatic life in the lake, which is an artificial lake created as a federal project by the Resettlement Administration and now owned by the U. S. Soil Conservation Service, Department of Agriculture, and which furnishes valuable fishing and other recreational facilities for residents of the surrounding area. In a letter from Mr. Homer G. Towns, Chief, Region... Biology Division, U. S. Soil Conservation Service, Fort Worth, Texas, dated December 3, 1942, addressed to Mr. H. B. Martin, State Conservationist, U. S. Soil Conservation Service, Baton Rouge, Louisiana, and referred by Mr. Martin to this Division, it was stated that Mr. Towns carefully examined the reports of this Division and that in his opinion the chemical (high salt) content observed would permit little if any plankton growth in the lake, which is necessary as a food supply for the fish population. The basis for this opinion was not stated, and, as will be indicated later, its correctness may be reasonably questioned. More recently a request for investigation of pollution of Corney Lake and tributary waters, as well as of Bayou Dorcheat (G.P. 7.15) by oil-field brine from Arkansas oil-fields was made by Mr. R. E. Youree, Chairman, Lions Club Committee, Haynesville, Louisiana, in a letter dated March 26, 1943, and addressed to the Commissioner of Conservation, by whom it was referred to this Division. In this letter it was stated that the salt water pollution was believed to be destroying fish life in the waters involved.

The present investigation was undertaken in order to determine whether or not the salt concentration in Corney Lake had increased since the last investigation as a result of gradual accumulation in the impounded water, an increase in the amount of brine discharged into the tributary waters, or for any other reason. Some additional preliminary observations of biological interest were made, and the biological implications of the available data are here discussed.

Corney Lake was visited by the senior author on April 15, 1943, and water samples were collected with the assistance of Mr. H. D. Burkhalter, Project Conservationist, U. S. Soil Conservation Service, Land Utilization Division, Bernice, Louisiana, who provided the necessary motor boat and was otherwise most helpful. Most of the samples were taken as nearly as possible at the same points and at the same depths as the corresponding samples taken on August 22, 1941, by Mr. T. M. Logan and J. B. Ferchaud of this Division, in the course of the most recent and most detailed previous survey of the lake (G.P. 96.2, 96.3). While exact duplication of the sampling stations was not possible in every case, it is believed that the present samples may be regarded as reasonably comparable, with respect to location, with the samples obtained earlier. A few additional samples were also obtained at other points or depths. The chloride content (and calculated sodium chloride content) of the samples was determined on April 26 by M. T. LoSavio. In the table which follows, the above data are presented together with the values obtained with approximately corresponding samples during the previous investigation, and the sampling station designations correspond with those used in the previous reports (G.P. 96.2, 96.3) in which the location of the stations had been mapped approximately. The samples listed as taken at Station A were clearly taken in a deeper place than the corresponding earlier samples, i.e., over a deep, narrow channel. However, some additional samples were taken at a nearby point near the middle of the dam, where the depth was more nearly the same as at the original Station A. This point is designated as Station A'.

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SCHEDULE A

Chloride Determinations in Water Samples from Corney Lake

Comparison of samples collected Aug.22, 1941, with similar samples collected Apr.26,1943.

Sample number	Station	Location	Depth	Results of analysis April 26,1943 (Anal:LoSavio)		Analysis of corresponding samples taken Aug.22,1941 (Analyst: Cusachs)	
				Chloride p.p.m.	As NaCl p.p.m.	Chloride p.p.m.	As NaCl p.p.m.
213	A	Corney Lake at dam	20 ft.	134	221	---	---
201	A	Corney Lake at dam	12 ft.	76	125	138	228
202	A	Corney Lake at dam	6 ft.	66	109	89	147
203	A	Corney Lake at dam	1 in.	65	107	87	144
215	A'	Corney Lake at dam	14 ft.	69	114	---	---
216	A'	Corney Lake at dam	1 ft.	68	112	---	---
214	B	Corney Lake: middle of lake between spillway and camp	7½ ft.	98	162	---	---
204	B	Corney Lake: middle of lake between spillway and camp	5 ft.	95	157	87	144
205	B	Corney Lake: middle of lake between spillway and camp	1 in.	98	162	87	144
206	C	Corney Lake, due N. of boat house, 1½ mile above dam (deep channel)	14 ft.	115	190	141	233
207	C	Corney Lake, due N. of boat house, 1½ mile above dam (deep channel)	7 ft.	83	137	172	284
208	C	Corney Lake, due N. of boat house, 1½ mile above dam (deep channel)	1 in.	78	129	88	145
209	D	Corney Lake, 2¾ miles above dam	4 ft.	140	231	80	132
210	D	Corney Lake, 2¾ mi. above dam	1 in.	142	234	81	134
211	E	Corney Lake, at bridge, State Hwy. 115	5 ft.	225	371	375	619
212	E	Corney Lake, at bridge, State Hwy. 115	1 in.	224	370	248	574
217	F	Three Creeks at bridge	1 in.	1450	2393	2825	4660

It will be noted that no increase of the salt content of the lake water is indicated since August, 1941. While the chloride content of some of the samples is slightly higher than that of the corresponding samples taken earlier, on the average the values are somewhat lower. The mean value for all the samples listed from Corney Lake (i.e., exclusive of the sample from Three Creeks) collected in August, 1941, is 148 p.p.m., while the mean for the corresponding twelve new samples is 117 p.p.m., and that for all the sixteen new samples taken in Corney Lake is 111 p.p.m. The mean for all the earlier Corney Lake samples with the exception of the two from Station E (which clearly are not representative of the main body of the lake) is 105 p.p.m., while the mean for the corresponding ten new samples is 96 p.p.m., and that for all the new lake samples, exclusive of Station E (i.e., 14 samples) is 95 p.p.m. Whether the decrease of the average values is indicative of an actual improvement of conditions, or is due only to fluctuations of the concentration and distribution of the salt can not be stated, but it can be concluded with confidence that the salt water pollution of the lake has not increased in intensity in the past 20 months, and that there is no indication of progressive accumulation of salt in the lake. The water level in the lake was relatively low at the time of the last sampling.

The chloride concentration in Three Creeks was found to be high as before, but only slightly more than half as great as in August, 1941. The chloride content here may be expected to be subject to considerably greater fluctuations than in the lake. The water in Three Creeks was very clear, and a number of young and adult fish of the sunfish family (Centrarchidae), including black bass, were seen at Station F. These fishes are the favorite game fishes of the area, and obviously they were neither injured nor driven out by salt concentrations many times greater than those present in Corney Lake.

Common salt (sodium chloride), the predominant salt in oil-field brines, usually is demonstrably harmful to fresh water fishes only in very high concentrations. Chloride concentrations of several thousand parts per million are tolerated indefinitely even by more or less sensitive species. Pure sodium chloride dissolved in pure water has some demonstrable toxic properties, but even under these conditions concentrations of several thousand parts per million are apparently required to kill fresh water fish. Relatively minute quantities of calcium and magnesium salts, which are present in solution in most natural surface waters and in brines, tend to counteract (antagonize) the toxic effects of the pure sodium salt, so that under most natural conditions even higher concentrations may be tolerated. The water in Corney Lake has been shown to be quite hard (H 1.2), the hardness indicating a high but not excessive calcium and magnesium content. Under these conditions the injuriousness of dissolved sodium chloride to fishes depends largely upon its osmotic effects, which are quite negligible at the salt concentrations noted in Corney Lake, and apparently become significant only when the osmotic pressure of the water approaches or exceeds

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the fairly high osmotic pressure of the fish's blood. Accordingly, fresh water fishes, including the favorite local game species, are frequently taken in coastal areas along with marine forms in decidedly brackish water, and also may be abundant in water heavily polluted with oil-field brine. Therefore, it is not at all surprising that fish appeared to be plentiful in Three Creeks, in spite of the high salt content, and the salt concentrations observed in Corney Lake certainly were not sufficient to cause direct damage to fish life.

Relatively little information is available on the effect of high salt concentrations upon other fresh water organisms which directly or indirectly serve as food for fishes, but the same general relationships may be expected to prevail. Some locally important aquatic fish-food organisms are known to be even more resistant to salt than most of the fishes (e.g., the fresh-water grass-shrimp), while others may be more sensitive. Variations of salinity may influence the planktonic flora and fauna in a qualitative sense, i.e., different forms may do well and become dominant in waters of different chemical composition or salt content. The senior author is unable to concur, however, with Mr. Towns in the opinion that salt concentrations such as those which have been observed in Corney Lake will permit little if any plankton growth in the lake. Chloride concentrations as high or higher than these occur in natural fresh waters which are not contaminated with brine, and are not therefore to be regarded as entirely abnormal. Perhaps the best evidence that can be presented to show that heavy pollution with oil-field brine does not prevent a rich plankton growth in initially fresh waters is the fact that one of the richest efflorescences of phytoplankton observed by the senior author in the inland waters of Louisiana, as well as an abundance of zooplankton, were found in water with a chloride content of about 4000 p.p.m. This observation was made on November 12, 1941, on Bayou Tigre in Iberville Parish, a sluggish stream which at the time was heavily polluted with oil-field brine, as well as with effluents from several sugar mills. The sugar mill pollution was the main subject of investigation, but the chloride determinations were made incidentally by the senior author. The upper reaches of this stream and connecting canals and tributaries were so polluted with the sugar mill wastes (organic matter) that anaerobic conditions prevailed at all levels, a great number of fishes were killed, and a normal fauna and flora could not exist. Below the zone of active decomposition, however, the stream showed rapid recovery near the surface, the dissolved oxygen content of the water increased rapidly and the water, enriched by nutrient materials derived from the decomposed organic matter, was so green with phytoplankton that the color was clearly detectable even when the water was dipped up in a small glass jar. Net plankton samples collected at a station in this zone, and later examined microscopically, contained abundant Phytomastigophorea, numerous Nauplii (larval Copepoda) and some Rotifera. Thus zooplankton, as well as phytoplankton, was not only maintaining itself, but also reproducing actively here. Yet analysis of water samples taken at this

station showed the chloride content to be 3685 p.p.m. at the surface, 3980 p.p.m. at a depth of 2 feet, 5368 p.p.m. at a depth of 4 feet, and 6849 p.p.m. at a depth of 6 feet near the bottom. Many fish were seen breaking the surface here. In view of these observations it seems scarcely probable that the much lower chloride concentrations observed in Corney Lake (everywhere less than one tenth as great, and much less than that on the average) will inhibit the growth of plankton.

Corney Lake is said to be producing an excellent crop of game fishes, and many residents of the surrounding area come there to fish. Thus, the fish population apparently has not been affected in the past by the continued moderate pollution with oil field brine, either directly or through destruction of their food supply. Since no progressive increase of salinity is indicated, there appears to be no reason, at present, for concern about the future productivity of the lake. It must be tentatively concluded, therefore, that there is no evidence that the pollution is biologically harmful. Additional observations should be made in the future, however, whenever opportunity presents itself. Sampling of the plankton and bottom food may yield valuable information, and any appreciable progressive increase of salinity in the future should be noted if it occurs.

Time was not available during the present investigation to undertake any detailed limnological survey of the lake. However, a few observations were made on the distribution of dissolved oxygen. In waters heavily polluted with brine (e.g., in Bayou Tigre discussed above) the resulting steep density gradient frequently interferes with normal vertical circulation of the water, with the result that the lower strata stagnate and are deficient in or free from oxygen even in water which is quite shallow. Damage to the bottom fauna results. The chloride concentrations in Corney Lake were clearly too low, however, and the observed vertical gradient too slight to produce this effect. Dissolved oxygen determinations showed that even in deep water outside of the old channel of Corney Bayou, ample oxygen was present near the bottom. At Station A' the dissolved oxygen content was 7.9 p.p.m. at the surface, and nearly the same (7.7 p.p.m.) near the bottom at a depth of 14 feet. Only at the bottom of the very narrow old Corney Bayou channel, where adequate circulation is apparently interfered with by the configuration of the bottom, was a deficiency of dissolved oxygen noted (0.1 p.p.m. at a depth of 16 ft. near the bottom at Station C, and undoubtedly none near the bottom at a depth of 20 feet at Station A, where no determination was made, but a distinct odor of hydrogen sulphide was detected). It should be noted that the depths at the stations at which the samples were taken are not representative of the average depth of the lake, since both stations A and C were located at the deep channel, which is very narrow and difficult to find, while the lake is much shallower on either side of this channel (apparently less than 8 feet over most of the area, except in the immediate vicinity of the dam).

Submitted by, Dr. Peter Doudoroff, Biologist
M. T. LoSavio, Chemist

Approved:
W. F. Chisholm

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DEPARTMENT OF CONSERVATION
Division of Research and Statistics

May 31, 1943

G.P. 96.4 (Supplement #1)
Corney Lake
Claiborne Parish

Water samples submitted by Dr. Peter Doudoroff, May 22, 1943.

Analysis by Mrs. R. V. Carney, Chemist, May 28, 1943.

Sample No.	Date	Location	Depth	PPM Cl	PPM NaCl
1	5/19/43	Corney Bayou above lake and Three Creeks	surface	137	226
2	5/19/43	Corney Lake near boat-house, toward spillway	surface	113	186
3	5/19/43	Corney Lake opposite boathouse	surface	113	186

Mrs. R. V. Carney,
Chemist.

DEPARTMENT OF CONSERVATION
Division of Research and Statistics

G.P. 96.4
Supplement No. 3
Corney Lake
Claiborne Parish

Memorandum

To: W.F.Chisholm

From: Dr. Peter Doudoroff, Biologist

Subject: Water samples from Corney Lake collected by Dr. Doudoroff, 10/29/43.

Sample No.	Date collected	Location	Depth	p.p.m. Cl	p.p.m. NaCl
1	10/29/43	Station A-near dam	surface	632	1043
2	10/29/43	Station A-near dam	6 ft.	637	1051
3	10/29/43	Station A-near dam	18 ft.	632	1043
4	10/29/43	Station B-middle of lake between spillway and camp	surface	632	1043
5	10/29/43	Station B- "	5 ft.	632	1043

M. T. Carney

Chemist

(Copy)

Appendix D-7

51.

UNITED STATES
DEPARTMENT OF AGRICULTURE
Soil Conservation Service

P. O. Box 1898
Fort Worth 1, Texas
February 4, 1949

Mr. Ernest S. Clements, Commissioner
Department of Wild Life & Fisheries
126 Civil Courts Building
New Orleans 16, Louisiana

Dear Mr. Clements:

Our attention has been called by Hon. Overton Brooks to a resolution by the Claiborne Parish Police Jury pertaining to pollution of Corney Lake from oil fields in Arkansas. We understand that a copy of the resolution was forwarded to you. Inasmuch as the pollution is affecting waters other than those on the Federal land we presume that your department will be interested in looking into the matter. Pertinent to it, we enclose a copy of our letter to Mr. Herbert E. Watkins, President Claiborne Parish Police Jury.

The following is a tabulation of our analyses of water from Corney Lake:

Date	Location	Depth	Total Solids	Chlorides Cl	HCO_3	Oil
5-7-48	Dam	4'	612 p.p.m.	260	21	Heavy
5-7-48	Center of Lake	4'	951 "	471	7	Moderate
5-7-48	Summerfield-Jct. City	5'	2074 "	979	2	Little
5-7-48	6 mi. N. of dam	4'	1820 "	954	5	Moderate
1-3-49	Dam	4'	2283 "	1204	2	None
1-3-49	Summerfield-Jct. C. Br.	4'	2334 "	1102	5	None
1-3-49	5½ miles N of dam	4'	2070 "	1108	4	None

We shall be pleased to cooperate in any way that we may to assist in investigations by your department.

Very truly yours,

sgd./Louis T. Merrill
Regional Conservator

STATE OF LOUISIANA
STREAM CONTROL COMMISSION
P.O.Box 9055, University Station
Baton Rouge 3, Louisiana

April 5, 1949

March 11-23, 1949
Samples submitted by Bill Bowers, March 11, 1949

Sample No.	Description	pH	p.p.m. Cl	p.p.m. NaCl
1	Big Corney Creek, 4½ miles from Corney Lake, 3/7/49	4.53	618	1020
2	Three Creeks, R. H. Hodge's house, 3/7/49	6.55	788	1300
3	Atlanta, Ark., Beech Creek, near oil field, 3/8/49	4.05	935	1543
4	Atlanta Oil Field, Tidewater leases, Creek, 3/8/49	3.05	3855	6361

M. T. LoSavio
Chemist

MTL:by

(Copy)

Appendix D-9

53.

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
P. O. BOX 1898
Fort Worth, Texas,

June 1, 1949

Honorable Ernest S. Clements, Commissioner
Louisiana Dept.of Wild Life & Fisheries
126 Civil Courts Bldg.
New Orleans, Louisiana

Dear Mr. Clements:

On February 4, 1949, I sent to you the results of any analysis that had been made of water from Corney Lake located in Claiborne Parish, Louisiana. This analysis showed that harmful concentrations of chlorides were being discharged into the lake. At various times over a period of years the lake has been polluted by waste from oil field operations, often in quantities sufficient to cause death of fish. It is our understanding that most of this waste comes from oil fields located in Arkansas. We have continued to make analyses of the water, and our latest studies made in March reveal the following:

Location	Total Solids P.P.M.	Chloride P.P.M.
Three Creeks Bayou, La., Hy. 15	2490	1231
Corney Bayou, La. Hy. 15	2594	1331
Corney Bayou, Center City Hwy.	906	431
Center of Spillway, Corney Lake	590	278
Near Dam	621	285

Data for April show:

Location	Total Solids P.P.M.	Chloride P.P.M.
Corney Bayou, Atlanta, Ark.	4922	2285
Upper Corney Lake	496	169
Near Dam	538	176

We have received a report of fish dying in May in contributing bayous but none in Corney Lake. Although concentrations of chlorides have been below dangerous levels in the lake in recent months, it will be noted that toxic conditions continue to occur in the streams. I would appreciate being advised if you have taken any steps to correct this situation.

Very truly yours,

sgd/ Louis P. Merrill
Regional Conservator

June 30, 1949

June 27-28, 1949

Samples from Corney Lake and Big Corney Creek, collected 6-15-49, submitted 6-24-49, by Bill Bowers.

Sample No.	Description	pH	p.p.m. Cl	p.p.m. NaCl
1	Big Corney Creek, 3½ miles from mouth of Lake	4.12	1473	2430
2	Big Corney Creek at mouth, Eldorado Highway	5.32	1312	2165
3	Corney Lake near boat landing, surface (Broken on arrival)	----	----	----
4	Corney Lake near boat landing, 8' bottom	6.49	629	1038
5	Corney Lake near Spillway, surface	5.85	651	1074
6	Corney Lake near Spillway, 10' bottom	5.73	915	1510
7	Corney Lake Channel, middle of Lake, surface	5.85	782	1290
8	Corney Lake Channel, middle of Lake, 16' bottom	6.76	1159	1912

M. T. LoSavio
Chemist

MTL:by

CORNEY LAKE AND CORNEY BAYOU

Analytical Data Furnished by
Soil Conservation Service,
U.S.Dept. of Agriculture,
Ruston, Louisiana

Date 1949	Sampling Point	Chlorides p.p.m.	Total Solids p.p.m.	pH
Jan				
3	Dam	1204	2283	---
3	Summerfield Junction City - Bridge	1102	2334	---
3	North edge of Lake 5½ miles north of Dam	1108	2070	---
Apr				
6	In Lake near Dam	285	621	5.7
6	Near center of current in Spillway	278	590	5.97
6	Under Bridge, Corney Bayou, Center City Highway	431	906	7.00
6	Corney Bayou - Bridge Arkansas Highway #15	1331	2594	5.74
6	Three Creeks Bayou Bridge, State Highway #15	1231	2490	7.2

Philip F. Allen

Analyst

CITIZENS RESIDING IN THE VICINITY OF BERNICE, LOUISIANA, INTERVIEWED JULY 14,1949, REGARDING FISH DESTRUCTION IN CORNEY CREEK ABOVE LAKE CORNEY.

C. W. James
Ruston, La.

W. A. Fielder
Lake Corney concessionaire

S. R. Aycock
Soil Conservation Service
Box 561
Ruston, La.

R. C. Pesnell
Soil Conservation Service
Bernice, La.

M. C. Chambless
Ruston, La.

J. G. Wells
Ruston, La.

Dick Taylor
Ruston, La.

C. R. Blackwell
Haynesville, La.

J. T. Browning
Haynesville, La.

H. V. Stokes
Homer, La.

W. C. Bates
Monroe, La.

W. L. Farmer
Ruston, La.

C. H. Elliott
Homer, La.

William Thomas, Jr.
Homer, La.

R. D. Harrell
Junction City, La.

D. W. Kelley
Junction City, La.

W. R. Thurmon
RFD No. 3
Bernice, La.

H. B. Cope

D. Fielder

ATLANTA FIELD

	1944	1945	1946	1947	1948
No. wells	38	49	52	55	58
Oil produced	1,165,178	1,333,740	1,587,294	1,467,491	1,384,374
Water produced Bbl.	98,228	313,141	582,666	881,312	1,522,600
Water injected	----	----	Aug. 25 started	To July 1 277,000	

MAGNOLIA FIELD

	1944	1945	1946	1947	1948
No. wells	111	111	111	111	114
Oil produced	5,563,426	4,956,394	4,716,975	4,646,110	4,621,103
Water production	755,841	930,094	1,434,311	2,222,984	2,484,899
Water injected	---	357,889	2,799,469	4,438,090	5,027,305

SCHULER FIELD

	1944	1945	1946	1947	1948
No. wells	163	161	161	161	161
Oil produced	4,765,736	4,418,181	4,176,866	3,827,742	3,708,025
Water production	1,290,466	2,457,922	2,383,936	1,904,203	2,213,352
Water injected	67,238	274,744	637,270	1,066,527	1,486,589

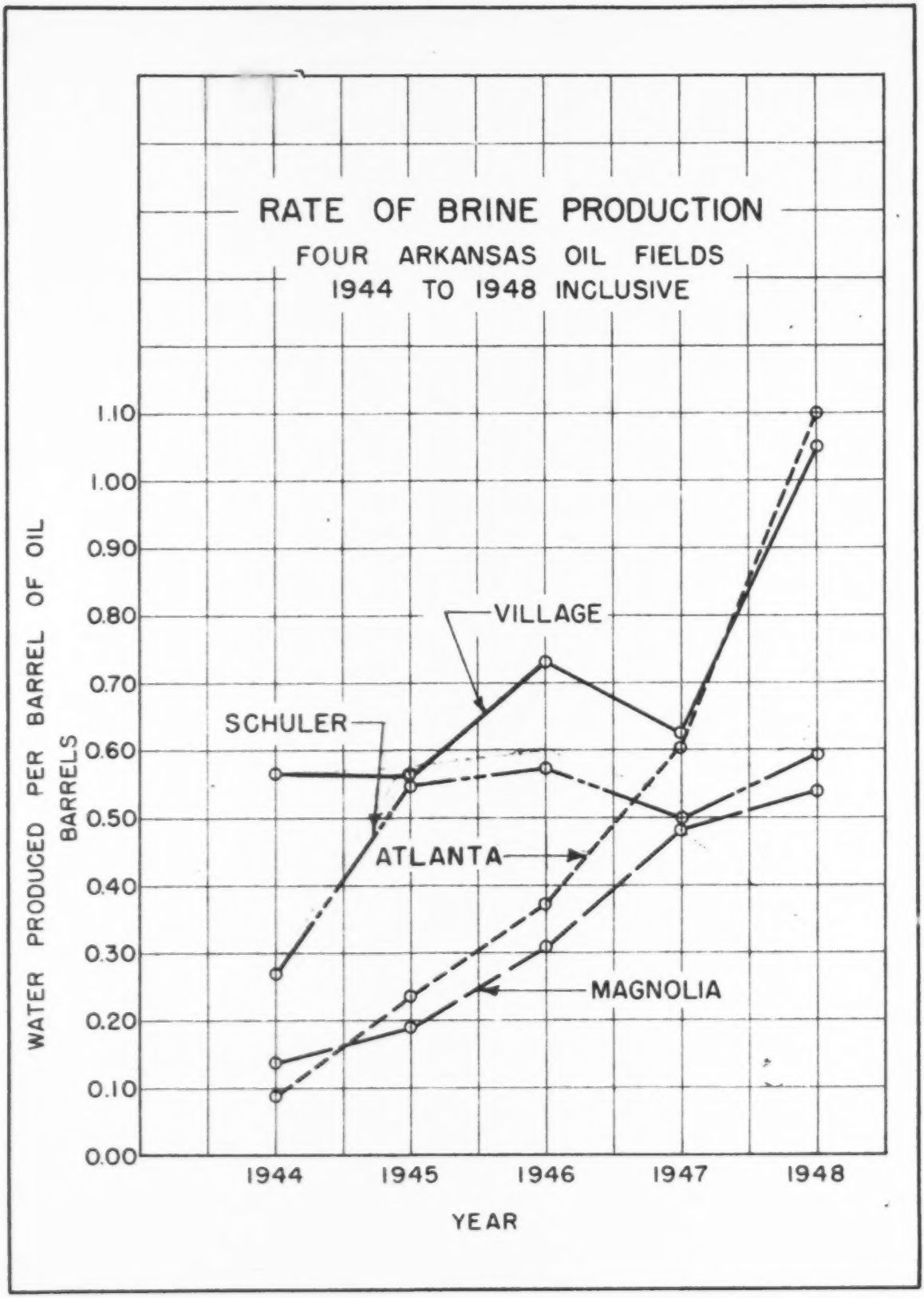
VILLAGE FIELD

	1944	1945	1946	1947	1948
No. wells	18	26	41	68	93
Oil produced	571,869	815,341	1,156,738	1,798,378	2,094,258
Water production	322,792	458,031	843,438	1,119,453	2,191,078
Water injected	--	--	--	--	--

WATER PRODUCED PER BARREL OF OIL (Bbl.)

Field	Year				
	1944	1945	1946	1947	1948
Atlanta	0.0843	0.2342	0.3680	0.6020	1.100
Magnolia	0.1360	0.1880	0.3040	0.4800	0.5380
Schuler	0.2710	0.5550	0.5715	0.4975	0.5960
Village	0.5640	0.5615	0.7300	0.6220	1.0480

APPENDIX G


RATE OF BRINE PRODUCTION
FOUR ARKANSAS OIL FIELDS
1944 TO 1948 INCLUSIVE
WATER PRODUCED PER BARREL OF OIL
BARRELS
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
VILLAGE
SCHULER
ATLANTA
MAGNOLIA
1944
1945
1946
1947
1948
YEAR

RESULTS OF ANALYSES FOR
STREAM AND LAKE SAMPLES COLLECTED
JULY 13 AND 14, 1949,
ARKANSAS STATE BOARD OF HEALTH.

	Cl	pH	NaCl
Lake Corney Discharge	1,092	6.9	1,800
Lake Corney 27' depth	2,125	5.9	3,500
Lake Corney 22' depth	1,756	6.1	2,900
Lake Corney 17' depth	1,395	6.5	2,300
Lake Corney 12' depth	1,700	5.5	2,800
Lake Corney 7' depth	1,213	7.1	2,000
Surface	1,093	6.1	1,800
Head of Lake Corney 6' bottom	2,000	5.6	3,300
Head of Lake Corney Top Sample	2,065	6.2	3,400
Three Creeks 3 miles above Corney Lake	4,246	6.3	7,000
Three Creeks at Hiway #15 Bridge Bottom	5,400	6.5	8,900
Top	5,770	6.7	9,500
Upper reeches Three Creeks above pollution	121	6.8	200
Big Corney Creek 6 miles above Lake	912	6.2	1,500
Big Corney Creek at Hiway #15	1,213	6.4	2,000
Big Corney Creek at Jamison Br. (above Atlanta below Village)	5,459	5.3	9,000
Village Creek	970	7.2	1,600
Pigeon Roost Creek, 1 mi. above Corney Creek (no pollution)	121	6.8	200
Ditch at Lion Oil, Morgan A Well #1	6,980	6.5	11,500
Magnolia Rogers Unit Farm well in Village Field (Below #5)	236,800	5.4	390,000